

**PROVIDING NECESSARY FLOOD PROTECTION
TO PROTECT COASTAL COMMUNITIES**

FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION
AND INFRASTRUCTURE

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

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MAY 15, 2015—NEW ORLEANS, LA
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ONE HUNDRED FOURTEENTH CONGRESS
FIRST SESSION

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PROVIDING NECESSARY FLOOD PROTECTION TO PROTECT COASTAL COMMUNITIES

FRIDAY, MAY 15, 2015

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
New Orleans, LA.

Senator VITTER. At this point, we're going to move to our witnesses, to sort of the Field Hearing portion of the program, so let me invite Colonel Hansen to come up. He is our first panel, sort of the Federal panel, and then after a discussion with Colonel Hansen, we will have another panel of witnesses.

Colonel Richard Hansen is the District Commander and District Engineer of the U.S. Army Corps of Engineers here in the New Orleans District. He became that 62d District Commander on May 23rd, 2013, and on assuming command, he became responsible for one of the largest civil works programs in the country at over \$300 million annually.

Colonel Hansen is in charge of executing and maintaining South Louisiana's Comprehensive and Integrative Flood Control Ecosystem Restoration and Hurricane and Storm Damage Risk Reduction Projects, which we were talking about earlier.

Colonel, welcome, and thanks for your work and thanks for your testimony today.

STATEMENT OF COLONEL RICHARD HANSEN, COMMANDER, NEW ORLEANS DISTRICT, U.S. ARMY CORPS OF ENGINEERS

Colonel HANSEN. Thank you, Chairman Vitter, and the members of the subcommittee. Again, I am Colonel Richard Hansen, Commander of the U.S. Army Corps of Engineers, New Orleans District.

Thank you for this opportunity to provide a status on the construction and maintenance of systems to reduce the risk associated with extreme coastal weather events.

I'd like to provide you with an update on the progress and status of our efforts during the last 10 years, the remaining work, and the coordinated efforts of the U.S. Army Corps of Engineers and its Federal, State and local partners, to ensure that we are prepared and ready to respond during the 2015 hurricane season. I will begin with a discussion of the response following Hurricane Katrina.

Immediately following Hurricane Katrina, the Corps assessed the damages from the storm, and working closely with State and other Federal agencies, took a comprehensive look at the organization to

determine how best to improve our approaches to storm risk reduction. We incorporated the lessons learned from that assessment into our design criteria, construction techniques, as well as our preparedness and response procedures.

The results included addressing risk reduction with more robust designs, use of cutting edge science and technology, incorporation of better materials, gaining insight from local, national and international experts in building a robust emergency preparedness and response network.

Additionally, the passage of supplemental appropriations totaling over \$14 billion represented full up-front funding for protective measures in Southeastern Louisiana. This allowed the Corps to efficiently design and construct this multifaceted system in one of the Nation's most complex environments.

The Corps has strengthened or improved nearly 133 miles of levees, floodwalls, gated structures and pump stations to form a perimeter system.

Construction of features, such as the Inner Harbor Navigation Canal Surge Barrier in Lake Borgne, the Seabrook Floodgate Complex, closures at the mouths of the three outfall canals, and the Gulf Intracoastal Waterway West Closure Complex, have pushed the line of defense outside the city and removed almost 70 miles of interior levees and floodwalls from exposure to storm surge.

We have provided the necessary data to the Federal Emergency Management Agency and they are currently revising their Flood Insurance Rate maps to reflect the system as being accredited to defend against the 100-year storm surge event, or a storm that has a 1 percent chance of occurring in any given year.

It is with confidence that I appear before you today and state that the level of storm damage risk reduction in the New Orleans metropolitan area has never been greater.

Each day this risk is even further reduced as we push to complete the final remaining features of the system. I'd like to highlight a couple of the endeavors currently under way, specifically, the construction of the Permanent Canal Closures and Pumps and the current effort to improve system resiliency through levee armoring.

In June 2013, we initiated construction of the Permanent Canal Closures and Pumps, the system's final major structural complex. Since that time, we have made substantial progress. As of this month, the design is nearly 94 percent complete, and construction and procurement are 57 percent complete.

We are on schedule to be complete at 17th Street, Orleans Avenue and London Avenue during the 2017 hurricane season. Once complete, the three new structures will be a sustainable replacement for the interim closure structures that currently provide the 100-year level of risk reduction.

These new stations combined will have a total pumping capacity of nearly 182,000 gallons per second. Additionally, adaptability has been incorporated into the design for the structures, should other options be authorized and funded for construction in the future.

Until these permanent features are complete, the Corps is committed to ensuring that the interim closure structures will perform

as designed through a comprehensive operations and maintenance program.

I'd also like to highlight our armoring program work. One of the lessons learned from Hurricane Katrina is the need for greater resiliency in the system. In terms of elevation, the system is designed to defend against surge levels associated with a 100-year level storm. We also understand that it is necessary to build a level of resiliency so that the system will withstand the impacts of overtopping from an even more intense storm.

To date, we have awarded five task orders for the placement of high performance turf reinforcement matting on earthen levees in the system.

Since 2006, the Corps has continued to incorporate lessons learned from Hurricane Katrina and improve how we do business, not only in design and construction of the HSDRRS, but also in operational and contingency planning.

In partnership with Federal, State and local leaders, we conduct annual structural assessments of the system. In conjunction with each hurricane season, the Corps and its partners operationally test all major structures and conduct joint hurricane exercises here in New Orleans, as well as at our Division Headquarters in Vicksburg, Mississippi.

The purpose of the exercises is to test the well-planned command and control procedures, our technical steps for responding to a storm event, the procedures and triggers for closing and reopening major structures, as well as the partnership and synchronized efforts among Federal, State and local agencies.

Our partners in these extensive planning efforts are the U.S. Coast Guard, the Coastal Protection and Restoration Authority, the New Orleans Sewerage and Water Board, the Jefferson Parish Drainage Department, the Governor's Office of Homeland Security and Emergency Preparedness, the Southeast Louisiana Flood Protection Authorities, and their supporting districts, and the Louisiana Department of Transportation and Development.

The first of these field tests for this hurricane season was successfully conducted by the Southeast Louisiana Flood Protection Authority—West on April 30, 2015.

As I meet with stakeholders, partners, media and the public, I am often asked about my greatest concern and vulnerability in the system. My greatest concern and what could also be considered a vulnerability is the risk of complacency of residents because this monumental system is now in place.

No matter how high or how big we build, no system can fully eliminate risk. And it's because of this residual risk that we continue to communicate with the general public in an open and transparent manner.

Each year, the Corps and all of our regional partners come together for an event at the start of hurricane season to collectively emphasize shared responsibilities at all levels.

And it's important that everyone has an emergency evacuation plan in place. Listen to your local officials and evacuate if an order is called. This event, this press conference, will be scheduled for May 27, 2015.

Again, we're fully confident that the Hurricane and Storm Damage Risk Reduction System will perform as designed just as it did during Hurricane Isaac.

Today, the system is in great shape and our non-Federal partners are doing a tremendous job with their operations and maintenance programs to keep the system prepared for response to a tropical weather event.

So, in closing, we are meeting the Nation's commitment to the citizens of Southeast Louisiana. We accomplish this by sharing responsibility and working collaboratively, relying heavily on our non-Federal partners, and on extensive collaboration with the general public.

I must emphasize that the Corps absolutely could not have done this work on its own. It was a team effort among Federal, State and local government, levee authorities, levee boards, academia, industry, non-government organizations, peer reviewers and other stakeholders.

Any additional work that is needed to reduce risk in coastal Louisiana should consider all methods of risk reduction: land use zoning, building codes, flood insurance, evacuation plans, hazard mitigation plans, wise use of flood plains, structural, and the appropriate combination of other non-structural measures.

The Corps is working on numerous civil works projects to support navigation, ecosystem restoration, and flood risk management in coastal Louisiana.

Recently, we executed a cost share agreement with the Louisiana Department of Transportation and Development to evaluate the feasibility of deepening the Mississippi River from Baton Rouge to the Gulf of Mexico, as well as an agreement with the Port of Lake Charles to implement the Dredge Material Management Plan, which will provide additional placement capacity to allow the continued maintenance dredging of the Calcasieu Ship Channel.

For coastal restoration, we have partnered with Plaquemines Parish to begin construction of the first Louisiana Coastal Area Beneficial Use of Dredged Material Project, which will create and restore marshlands in West Bay, with material dredged, as part of our Mississippi River Maintenance Program, and it will also provide a natural buffer against future coastal storms.

Finally, we are also working on additional flood risk management efforts, such as the Comite River Diversion Project in the Baton Rouge area and the Southwest Coastal Louisiana Integrated Flood Risk Reduction and Coastal Restoration Study.

Addressing the needs of this important region, especially in the area of managing flood risk, will require the shared efforts of our local, State and Federal partners. The men and women of the U.S. Army Corps of Engineers, New Orleans District, are residents of South Louisiana. Their friends and families live here; they maintain active roles in their communities. For them, working with our partners to ensure a promising future in coastal Louisiana is not just a professional responsibility; it is a personal commitment.

Mr. Chairman, thank you for allowing me to testify before you this morning. I will be happy to answer any questions you may have. Thank you.

[The prepared statement of Colonel Hansen follows:]

**DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS**

COMPLETE STATEMENT

OF

**COLONEL RICHARD HANSEN
COMMANDER, NEW ORLEANS DISTRICT
U. S. ARMY CORPS OF ENGINEERS**

**Committee on Environment and Public Works
Subcommittee on Transportation and Infrastructure**

**Providing Necessary Flood Protection to Protect Coastal
Communities**

May 15, 2015

Introduction

Chairman Vitter and member of the Subcommittee, I am Colonel Richard Hansen, commander of the U.S. Army Corps of Engineers, New Orleans District. Thank you for the opportunity to provide a status of the construction and maintenance of systems to reduce the risk associated with extreme coastal disasters.

Hurricane and Storm Damage Risk Reduction System

I would like to provide you an update on the progress and status of our efforts during the last ten years, the remaining work, and the coordinated efforts of the U.S. Army Corps of Engineers (Corps) and its federal, state and local partners to ensure that we are prepared and ready to respond during the 2015 Hurricane Season. I will begin with discussion of the response following Hurricane Katrina.

Immediately following the passage of Hurricane Katrina, the Corps assessed the damages from the storm and, working closely with state and other Federal agencies, took a comprehensive look at the organization to determine how best to improve our processes and procedures. We incorporated the lessons learned from that assessment into our design criteria, construction techniques, as well as our preparedness and response procedures. The results included addressing risk reduction with more robust designs, use of cutting edge technology, incorporation of better materials, gaining insight from local, national and international experts, that achieves a more robust emergency preparedness and response network.

Additionally, the passage of supplemental appropriations totaling over \$14 billion for protective measures in Southeastern Louisiana allowed the Corps to efficiently design and construct this multifaceted system in one of the Nation's most complex environments.

The Corps has strengthened or improved nearly 133 miles of levees, floodwalls, gated structures and pump stations to form a perimeter system. Construction of features such as the Inner Harbor Navigation Canal Surge Barrier in Lake Borne, the Seabrook Floodgate Complex, closures at the mouths of the three outfall canals and the Gulf Intracoastal Waterway West Closure Complex, have pushed the line of defense outside of the city and removed almost 70 miles of interior levees and floodwalls from exposure to storm surge. We have provided the necessary data to the Federal Emergency Management Agency and they are currently revising their Flood Insurance Rate Maps to reflect the system as being accredited to defend against the 100-year storm surge event, or a storm that has a 1-percent chance of occurring in any given year. It is with immense pride that I appear before you today and make the following statement with

total confidence – because of the Hurricane and Storm Damage Risk Reduction System (HSDRRS), the level of storm damage risk reduction in the New Orleans metropolitan area has never been greater.

Remaining Work

Each day, this risk is even further reduced as we push to complete the final remaining features of the system. I would like to highlight a couple of the endeavors currently under way, specifically the construction of the Permanent Canal Closures and Pumps and the current effort to improve system resiliency through armoring.

In June 2013, we initiated construction of the Permanent Canal Closures and Pumps, the system's final major structural complex. Since that time, we have made substantial progress. As of this month, the design is roughly 94 percent complete and construction and procurement are 57 percent complete. We are on schedule to be complete at 17th Street, Orleans Avenue and London Avenue by the 2017 hurricane season. Once complete, the three new structures will be a sustainable replacement for the interim closure structures that currently provide the 100-year level of risk reduction. These new stations combined will have a total pumping capacity of nearly 182,000 gallons per second. Additionally, adaptability has been incorporated into the design for the structures, should other options be authorized and funded for construction in the future. Until these permanent features are complete, the Corps is committed to ensuring that the interim closure structures will perform as designed through a comprehensive operations and maintenance program

I would also like to highlight our armoring program work. One of the lessons learned from Hurricane Katrina is the need for greater resiliency in the system. In terms of elevation, the system is designed to defend against surge levels associated with a 100-year level storm. We also understand that it is necessary to build a level of resiliency so that the system will withstand the impacts of overtopping. To date, we have awarded five task orders for the placement of high performance turf reinforcement matting.

Hurricane Preparedness

Since 2006, the Corps has continued to incorporate lessons learned from Hurricane Katrina and improve how we do business - not only in design and construction of the HSDRRS, but also in our operational and contingency planning. In partnership with federal, state and local leaders, we conduct annual structural assessments of the system. Prior to the start of each hurricane season, the Corps and its partners

operationally test all major structures and conduct joint hurricane exercises here in New Orleans as well as at our Division headquarters in Vicksburg, Mississippi. The purpose of the exercises is to test the well-planned command and control procedures, our technical steps for responding to a storm event, the procedures for closing and reopening major structures, as well as the partnership and synchronized efforts among federal, state and local agencies. Our partners in these extensive planning efforts include the U.S. Coast Guard, the Coastal Protection and Restoration Authority Board, the New Orleans Sewerage and Water Board, the Jefferson Parish Drainage Department, the Governor's Office of Homeland Security and Emergency Preparedness, the Southeast Louisiana Flood Protection Authorities and their supporting districts and the Louisiana Department of Transportation and Development. The first of our field tests for this hurricane season was successfully conducted by the Southeast Louisiana Flood Protection Authority-West on April 30, 2015.

Residual Risk

As I meet with our stakeholders, partners, media and the public, I am often asked about my greatest concern and vulnerability in the system. My greatest concern, and what could also be considered our greatest vulnerability, is the risk of complacency of residents because this monumental system is now in place. No matter how high or how big we build, no system can fully eliminate risk. It is because of this residual risk that we continue to communicate with the general public in an open and transparent manner. Each year, the Corps and all of our regional partners come together for an event at the start of Hurricane Season to collectively emphasize shared responsibilities at all levels of government, and the importance of having an emergency evacuation plan in place, listening to their local officials and evacuating if an order is called. The event is scheduled for May 27, 2015.

Again, we are fully confident that the Hurricane and Storm Damage Risk System will perform as designed just as it did during Hurricane Isaac. Today, the system is in great shape and our non-federal partners are doing a tremendous job with their operations and maintenance programs to keep the system prepared in response to a tropical weather event.

Closing

In closing, we are meeting the Nation's commitment to the citizens of Southeast Louisiana. We accomplish this by sharing responsibility and working collaboratively, relying heavily on our non-federal partners and on extensive collaboration with the general public. I must emphasize that the Corps could not have done this work on its own – this was absolutely a team effort – federal, state, local government, levee authorities, levee boards, academia, industry, non-governmental organizations, peer reviewers and other stakeholders.

Any additional work that is needed to reduce risk in coastal Louisiana should consider all methods of risk reduction: land use zoning, building codes, flood insurance, evacuation plans, hazard mitigation plans, wise use of flood plains, structural, and the appropriate combination of other non-structural measures.

The Corps is working on numerous civil works projects to support navigation, ecosystem restoration, and flood risk management in Coastal Louisiana. Recently, we executed a cost share agreement with the Louisiana Department of Transportation and Development to evaluate the feasibility of deepening the Mississippi River from Baton Rouge to the Gulf of Mexico, as well as an agreement with the Port of Lake Charles to implement the Dredge Material Management Plan, which will provide additional disposal capacity to allow the continued maintenance dredging of the Calcasieu ship channel.

For coastal restoration, we have partnered with Plaquemines Parish to begin construction of the first Louisiana Coastal Area Beneficial Use of Dredged Material project, which will create and restore marshlands in West Bay with material dredged as part of our Mississippi River maintenance program, which will also provide a natural buffer against future coastal storms. Finally, we are also working on additional flood risk management efforts, such as the Comite River Diversion project in the Baton Rouge area and the Southwest Coastal Louisiana integrated flood risk reduction and coastal restoration study.

Addressing the needs of this important region, especially in the area of managing flood risk, will require the shared efforts of our local, state and federal partners. The men and women of the U.S. Army Corps of Engineers, New Orleans District are residents of South Louisiana. Their friends and families live here; they maintain active roles in their communities. For them, working with our partners to ensure a promising future in Coastal Louisiana is not just a professional responsibility; it is a personal commitment.

Mr. Chairman, thank you for allowing me to testify before you this morning. I will be happy to answer any questions you may have.

Senator VITTER. Thank you, Colonel. Thanks for your work and that of all of your colleagues in the Corps. Thanks for all of your ongoing leadership and work, and thanks for being here today.

You mentioned that you think the greatest vulnerability, danger of our new system is complacency. After that, in terms of if you look at the physical post-Katrina system, what would you say are the three top vulnerabilities or gaps of any kind and what is the Corps doing to address those?

Colonel HANSEN. Well, Senator, first, I will say that the Corps greatly values your leadership in the development and passage of the Water Resources Reform and Development Act of 2014. That does represent significant progress in advancing many water resources projects around the country, including here in the Greater New Orleans area.

Correct, I did mention complacency among citizens, that we don't want to develop a feeling or a belief that you can stay in the city for any Category 1 or any Category 2 hurricane; you don't have to evacuate until they reach a Category 3. That would be an incorrect way of thinking. Any hurricane could be dangerous regardless of its category.

For example, Hurricane Isaac was a Category 1 storm, but very wide and very slow moving. It pushed a lot of surge in front of it. There's a lot more factors to wind speed than category.

But, Senator, to talk about other vulnerabilities, as you mentioned in the slide you showed, in your presentation, we are presently armoring many miles of the earthen levees around the system.

Of that 133-mile perimeter, approximately 80 miles are earthen levees, and one of the lessons learned from Katrina is that levees need to be resilient to potential overtopping. So we are going back, now that those levees have been constructed, and we are beginning to place high performance turf matting and then grass over the top of those levees.

And our tests have shown that—we tested cross-sections of grass with that matting, at 40 times what we had said is the initial limit for overtopping, and we found no failure and no sign of erosion in levees that were protected with that armoring mat. So armoring makes levees much more resilient to an even larger storm, a 300-year storm, a 500-year storm.

So delaying that armor, if we do not move forward with that armoring, it does represent somewhat of a vulnerability. The system is capable of performing to a 100-year level storm, but if there were an even larger storm and the system was not armored, the levees could be potentially subject to damage from erosion from significant overtopping.

Senator, it's difficult to categorize or kind of rank other vulnerabilities, but obviously maintaining the system long-term requires a system-wide approach and really sharing of resources throughout the system.

You know, if levee lifts in one area need to be performed before another area—right now levee districts are limited in their ability to share resources and share funds, and that is going to, in a degree, is going to limit the system-wide approach to maintenance in the future, so I would consider that somewhat of a vulnerability.

You know, beyond that, I know that, you know, you're going to want to talk about the West Closure Complex and the surge barrier. Some of these large structures are very big. They are expensive to operate and maintain, and it takes resources on behalf of, you know, the non-Federal sponsor, the local levee districts and the Federal Government. And so, you know, the question is whether those resources will continue to be adequate in the future to maintain those structures, and I'll say that we have to continue to operate as a team and be committed to approaching that, you know, with the best plan possible.

Senator VITTER. Great. Well, that leads to our discussion of that O&M issue, and I appreciate your kind words about the WRRDA 2014 bill that I helped draft and pass, but you can tell your superiors that rather than kind words, what I really want is simply the Corps to follow the law in regard to that. And we've had this meeting and discussion many times, but the Corps isn't.

I mean, WRRDA 2014 has crystal clear language that the Corps has a responsibility to perform operation and maintenance on the IHNC Surge and Barge Sector Gates, on the West Closure Complex and on the Harvey Canal Sector Gates, and that the cost share is 65 Federal and 35 local.

I have a few questions about this, but let me start with this. Is there anything in that WRRDA language that you think is unclear or ambiguous?

Colonel HANSEN. Well, Senator, the WRRDA 2014 legislation is clear in assigning responsibility to the Secretary of the Army for operating and maintaining the structures that you named, and that is the correct list from our analysis, at 65 percent Federal and 35 percent non-Federal expense.

Senator VITTER. OK. So the obvious next question is why isn't—we're less than 2 weeks away from the start of hurricane season. So why isn't the Corps doing that?

Colonel HANSEN. Senator, the Corps has not ignored the authorization and plans to comply with the statute should operations and maintenance funding be provided. You know, specific appropriated funds were not provided for this purpose, but we've had this discussion as—and, you know, Congress did provide the Corps with an additional \$1 billion in discretionary operations and maintenance funding for 2015.

And, Senator, again, the Corps of Engineers and all the non-Federal sponsors and stakeholders that operate projects across the country are very grateful for that additional funding. It helps the Corps address critical backlog maintenance needs across the country, including here in Louisiana.

But this national backlog and deferred maintenance of structures and facilities and navigation channels across the country is \$140 billion, so even with the additional \$1 billion in discretionary funding—and, again, it's very useful and very welcomed—there are very hard choices to make and many, many critical needs still remain unfunded. And, regrettably, with demands exceeding the limited resources, no funds were allocated for the Federal share of the O&M for the HSDRRS fuel tax waterway structures.

Regarding a path forward, if discretionary O&M funding is provided to the Corps in Fiscal Year 2016, I cannot commit the Corps

to a particular decision, but the critical nature of these structures is well understood and it will receive very careful consideration.

Senator VITTER. So basically your answer is, we're not doing it, even though it's clearly our responsibility, because we don't have the money to do it?

Colonel HANSEN. Senator, as you know, the two steps that are required are the authorization and the funding, and, again, within that discretionary funding that was provided, you know, with the immense backlog of maintenance in structures, this was one of the needs that was not able to be funded.

Senator VITTER. So you know how the process works. The Corps, through the administration, submits a proposed budget to Congress. Did the Corps ask for that money?

Colonel HANSEN. Senator, I am not, you know, fully aware of every step in the budget process. I know it was actively considered in the fiscal year '15 work plan allocation of that O&M funding, but I can't offer, you know, whether or not it was in the 2015 budget. The implementation guidance of that particular section of WRRDA did arrive late enough in the 2016 President's budget development process and it was not included.

Senator VITTER. So, again, I'm trying to cut through to the core, the responsibility is crystal clear that it's at the Corps. The Corps has not even asked for the money, and to piggyback on your comments about the billion dollars, the Corps was given an extra billion dollars for various O&M needs. And I know you have way more O&M needs than that. But you were given a billion dollars, with no direction, and the Corps chose not to use a penny of it for this mandated responsibility, is that correct?

Colonel HANSEN. That is accurate, Senator.

Senator VITTER. OK. Well, I just think that's inexcusable, and I know it's a decision by your superiors, and I know that the district actively asked for the money, but the responsibility is crystal clear, and for the Corps not to meet the responsibility, not to even ask for the money to meet the responsibility, and to be given a billion dollars which could be used for the responsibility, and not to use a penny, I think, is ridiculous, quite frankly.

So, as you know, we're not going to drop this issue, and I can tell you, if I have anything to do with it, as the next Governor, my direction, in January, is going to be very simple to the local authorities. It's going to be to drop off the keys to these three structures at the Corps office, literally, drop off the keys. We will send you a monthly check for our 35 percent and it's going to be on you. So y'all have between now and January to figure it out, but that's what's going to happen.

Let me move to levee lifts, which is another really important issue. Before Katrina, in the construction of our protection system, future levee lifts to bring the system back up to required height, after subsidence, was part of the design, was part of the authorization.

That was not built into the design and authorization of this new system, so that now, as subsidence happens, and we need to periodically do levee lifts—and that's normal; I mean, that's part of any levee system, as you know—the Corps is saying, "Oh, not on us. It has to be a 100 percent State and local burden." That was never

the case before. It's always been built into the system. It's always been the same cost share, which is 65 percent Federal, 35 percent State. So why did that change with this new system?

Colonel HANSEN. Senator, again, a very important issue, and Congress directed the Corps of Engineers to build a comprehensive risk reduction system for the Greater New Orleans Area that would provide a 100-year level risk reduction and could be accredited by FEMA, under the National Flood Insurance Program, and the Corps accomplished that and completed initial attainment by September 2011, and then in February 2014, the system was formally accredited by FEMA, and FEMA is in the process of updating the Digital Flood Insurance Rate maps that are applicable to the National Flood Insurance Program.

And, Senator, you are correct, the authorizing legislation for that system and for that project was silent on future levee lifts.

And then, Senator, again, you know, with your leadership with the Water Resources Reform and Development Act passage, Section 3017 of that Act does provide additional guidance on future levee lifts for the Hurricane and Storm Damage Risk Reduction System. It does require that the Secretary of the Army determine that future levee lift work, to address all the steps that caused the levee to settle, consolidation, settlement and subsidence, that if future levee lift work is technically feasible, environmentally acceptable and economically justified.

And as you know, Senator, that requires a decision document. In this case, it would be a General Re-Evaluation Report, and that would be conducted with investigation funds, under a cost-sharing agreement.

Senator VITTER. OK. Basically, to summarize for folks here, that means we have to go through all of this rigmarole study that's going to be long and drawn out and may not even get to a "yes," to do regular levee lifts that, prior to Katrina, were always built into the system.

And so what we have going on is normal subsidence that is bringing the system below the design level, below the 100-year level, with no appropriate plan involving the Corps to remedy that, on a regular basis, and, again, this is really unacceptable.

To date, isn't it true that the Corps has performed some lifts on levees within the system, like in St. Bernard Parish?

Colonel HANSEN. Senator, in constructing a levee, you know that there's a lot more to a levee reach than just the earthen levee itself. Oftentimes, there are some loose gates, you know, concrete slope paving in sections of floodwall, and so in the—and then we establish a good quality turf or a strong turf on the levee before we turn it over to the non-Federal sponsor.

And you're right, Senator, the conditions that cause levees to settle are very dynamic here in south Louisiana. There have been cases where, as we go through the several-year construction process of a large levee and get to the point of establishing turf and we go out and do our surveys, we find that it has settled small amounts below the initial design elevation.

And so in those cases, Senator, before—we have always made sure that before we turn a levee over to the non-Federal sponsor,

to the State and the levee district, that it is above the design grade.

So there have been cases where we went out, we have gone back out and done limited lifts. In 2012, the Corps actually did lifts on eight different reaches before turning them over to the non-Federal sponsor. Once that turnover process is complete, then it falls into the category, Senator, as we're discussing now.

Senator VITTER. OK. Well, again, I just want to highlight the concern. Over time we have this subsidence, and as it stands now, the Corps is walking away from any responsibility to help us keep the system at the design level. That was never the case before, never, ever. It was always built into the design and authorization that the Corps, 65/35, same cost share as normal, would do those regular lifts to keep the system up to its design level.

OK. I think, Colonel, that goes through my main areas that I wanted to focus on. We have a second panel, so I do want to give them ample opportunity, but thanks very much for being here today.

Colonel HANSEN. Well, thank you, Senator, and again, thanks for your leadership.

[Applause.]

Senator VITTER. And if I could ask our second panel to come up and be seated, and as they do, I will be introducing them.

We're really pleased to have four experts and individuals from the local area. First, Mr. John Monzon, P.E., Regional Director of the Southeast Louisiana Flood Protection Authority—West. That's the main levee board on the westbank and John is the head of it. Prior to serving in that capacity, John was Operations Division Chief with the Louisiana Coastal Protection and Restoration Authority, which was responsible for oversight and technical review of all of this work at the State level, and he was also CPRA liaison between the levee districts and the Corps for levee accreditation.

We also have Todd Murphy, President of the Jefferson Parish Chamber of Commerce. Todd has served as the President for the past 3 years and represents businesses in the largest parish in the New Orleans region, in terms of population, a number of businesses and a number of jobs. Prior to leading the Chamber, Todd served as Senior Vice President of Omni Bank and Iberia Bank for 13 years, where he guided new business development and government relations.

Bob Turner is Regional Director of the Southeast Louisiana Flood Protection Authority—East, so that's sort of the main levee board on the east bank. And Bob is a Registered Professional Civil Engineer with 30 years' experience in engineering. In 2007, Bob was appointed to his position and charged with oversight of flood protection for all or part of five parishes surrounding Lake Pontchartrain and the governance of the Orleans, East Jefferson and Lake Borgne Basin Levee Districts. Bob has an extensive background in hurricane and flood protection.

And last, but certainly not least, is Shirley Laska, Ph.D., Professor Emerita, Sociology, at UNO. Dr. Laska is a Professor, Emerita, of Sociology and Founding Past Director of the Center For Hazards Assessment Response and Technology at UNO. It's called UNO-CHART. She's been conducting applied research on natural

and technological hazards and disaster response for 30 years and her work includes studies on residential flood mitigation, hurricane response, coastal land loss effects, coastal fisheries and many other topics.

Thank you all for being here. More importantly, thanks for all of your ongoing work in this area, and we'll hear 5-minute testimony from each of you, in the order that I introduced you, starting with John.

STATEMENT OF JOHN R. MONZON, P.E., M. ASCE, REGIONAL DIRECTOR, SOUTHEAST LOUISIANA FLOOD PROTECTION AUTHORITY—WEST

Mr. MONZON. Good morning, Senator Vitter—

Senator VITTER. Good morning.

Mr. MONZON [continuing]. Chairman Vitter, and members of the committee. Thank you for giving me this opportunity this morning.

As you stated earlier, I am the Regional Director of the Southeast Louisiana Flood Protection Authority—West. We are in charge of two levee districts on the Westbank, of the Greater New Orleans area, namely the Algiers and West Jefferson Levee Districts.

The SLFPA-West oversees the operation and maintenance of over 100 miles of westbank and vicinity levees, including 33 miles along the Mississippi River and 67 miles of hurricane protection levees.

The Westbank Hurricane Protection Project began in 1986, when Congress secured authorization and funding to have the United States Army Corps of Engineers build the Westbank Hurricane Protection Levees, starting at Westwego to the Harvey Canal.

The entire Westbank and Vicinity System was incomplete at the time that Katrina made landfall on the shores of Louisiana. If Hurricane Katrina had shifted over to the west and made its way up Barataria Bay, the entire westbank would have flooded.

Based on lessons learned from levee and floodwall failures in the New Orleans area that were caused by storm surge, the Corps of Engineers received appropriations from Congress to design and build the HSDRRS features on the Westbank and Vicinity Projects.

In the nearly 10 years since Hurricane Katrina has passed, the Westbank and Vicinity Projects are now nearly complete and the citizens inside this system have the best level of hurricane protection they have ever experienced.

While there were some good outcomes from the construction of the Westbank and Vicinity HSDRRS projects, there were a couple of hardships along the way.

One of the hardships was caused by the June 1st, 2011 deadline to finish the HSDRRS. There were contractors that were aware of this deadline and used it to their advantage when negotiating change orders. In some cases, the deadline created sloppy construction practices and an environment where quality control was lacking.

Such was the case on the WBV 14c.2 Project where the contractor stretched the limits of blending in the soil specifications and caused an inordinate amount of woody debris in the levees. Eventually the Corps did agree to a task force that investigated the effects of the woody debris in the levees.

On the positive side, as a lesson learned, the task force recommended a compromise in which parts of the levee that had the most woody debris were capped with additional clean clay. It also recommended that the soil specifications be amended to limit the amount of organic material and better define the allowable blending process.

Some of the sloppy construction could have been averted if the construction contracts would have included provisions for a timely halt in construction in order to give the non-Federal sponsor and local sponsors an opportunity to seek corrective measures from the Corps. Also, contracts should have had a considerable retainer, in the amount of 10 percent or above, and those retainers should not have been paid until the Federal and non-Federal sponsors were satisfied that the contract is complete and finished according to plans and specifications.

A second hardship that was encountered along the construction process was caused by the division of the HSDRRS projects between the Hurricane Protection Office, HPO, and the Protection and Restoration Office, the PRO. There were inconsistencies in construction practices and design waivers, such as the use of uncoated steel piles and the lack of cathodic connectivity between the piles.

An expert review panel on the Greater New Orleans HSDRRS design guidelines concurred that the use of sacrificial steel is not a good practice in this region.

Most of these issues occurred on the Lake Pontchartrain and Vicinity projects managed by the HPO office and will arguably add maintenance costs over the life of the projects. For consistency, all future projects should be operated out of one office.

Some well-intended specification changes during construction created other hardships. In order to build stronger earthen levees, the soil specifications were changed to increase the clay content and decrease the organic content.

This created a problem in establishing a grass cover on the levees, because the clay was too hard to allow the root mass to become established and the soil did not contain enough organic material to encourage root growth. This became a problem because levees without grass cover are susceptible to erosion during rain events. In some cases, the contract was considered complete without adequate turf establishment.

The projects were turned over to the non-Federal sponsor where the Corps had to take corrective measures with hired labor forces. This wound up costing more time and money. In the future, specification changes should be vetted by the non-Federal sponsor prior to wholesale changes.

In conclusion, the Westbank and Vicinity is better prepared against storm surge from tropical events. The West Closure Complex has closed the entry point of storm surge into the Harvey and Algiers Canals and has reduced potential flooding in these basins.

The cost to operate, maintain, repair, rehabilitate and replace this \$1 billion facility is approximately \$3 million per year. This is a heavy burden to the local sponsors without Federal participation.

Most of the HSDRRS projects are complete, with the exception of some project modifications and armoring. The Corps was man-

dated to provide resiliency to the system for storm events greater than the 100-year storm.

The Corps chose to use armoring products to provide this level of resiliency, in lieu of additional height. These armoring products were tested at the University of Colorado and proved to be effective in providing erosion resistance from overtopping events. However, the system is still susceptible to overtopping and flooding will still occur, depending on the size of the storm. There are homes and places that will flood again.

Moreover, the recently awarded armoring contracts have indicated that it will cost as much to armor the levees as it will cost to raise the levees an average height of 2 feet.

The Corps has also indicated the future costs to lift and armor these levees will be the responsibility of the non-Federal sponsor.

Future costs to lift and armor these levees should be cost-shared between the Corps and the non-Federal sponsor, as stipulated in the WRRDA bill, at a 65/35 percent cost share.

We are hopeful that recent mandates in the 2014 WRRDA bill will bring some relief to the local sponsors as we begin to operate, maintain and repair, rehabilitate and replace the Westbank and Vicinity projects.

Again, thank you for giving me this opportunity.
[The prepared statement of Mr. Monzon follows:]

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Testimony for Public Hearing

Before the

Senate Committee on Environment and Public Works

On

Providing Necessary Flood Protection to Protect Coastal Communities

May 15, 2015

9:30 A.M. New Orleans Lakefront Airport Walnut Room

John R. Monzon, P.E., M. ASCE

Regional Director

Southeast Louisiana Flood Protection Authority- West

7001 River Road

Marrero, LA 70072

Dear Chairman Vitter, Ranking Member Boxer and Members of the Committee,

My name is John R. Monzon and I am a lifelong resident of Southeast Louisiana. I am a licensed Civil Engineer with 21 years of civil and public works engineering experience. I spent the first 14 years of my career with the Department of Transportation designing roads, bridges, drainage and flood protection features. I also spent 6 years with the Coastal Protection and Restoration Authority as the Operations Division Chief overseeing the implementation of hurricane protection and coastal restoration projects in coastal Louisiana, including the Hurricane and Storm Damage and Risk Reduction System (HSDRRS) in the Greater New Orleans area (GNO). Currently I serve as the Regional Director of the Southeast Louisiana Flood Protection Authority - West (SLFPAW). We are in charge of two levee districts on the Westbank of the GNO namely the Algiers and West Jefferson Levee Districts. The SLFPAW oversees the operation and maintenance of 100 miles of West Bank and Vicinity (WBV) levees; 33 miles on the Mississippi River and 67 miles of hurricane protection levees.

The WBV Hurricane Protection Project began in 1986, when Congress secured authorization and funding to have the U.S. Army Corps of Engineers build the Westbank Hurricane Protection Levee, Westwego to Harvey Canal. The entire WBV project was incomplete at the time that Katrina made landfall on the shores of Louisiana in 2005. If Hurricane Katrina had shifted over to the west and made its way up Barataria Bay, the entire Westbank would have flooded. Based on lessons learned from levee and floodwall failures in New Orleans caused by storm surge, the Corps of Engineers received appropriations from Congress to design and build HSDRRS features on the WBV projects. In the nearly ten years since hurricane Katrina, the WBV projects are now nearly complete and the citizens inside this system have the best level of hurricane protection they have ever experienced. While there were some good outcomes from the construction of the WBV HSDRRS projects, there were a couple of hardships along the way.

One of the hardships was caused by the June 1, 2011 deadline to finish the HSDRRS. There were contractors that were aware of this deadline and used it to their advantage when negotiating change orders. In some cases the deadline created sloppy construction practices and an environment where quality control was lacking. Such was the case on the WBV 14c.2 project where the contractor stretched the limits of blending in the soil specification and caused an inordinate amount of woody debris in the levees. Eventually the Corps agreed to a task force that investigated the effects of the woody debris in the levees. On the positive side, the task force recommended a compromise in which parts of the levee that had the most debris would be capped with additional clean clay. It also recommended that the soil specification be amended to limit the amount of organic material and better define the allowable blending process. Some of the sloppy construction could have been averted if the construction contracts would have included provisions for a timely halt in construction in order to give the Non Federal Sponsor (NFS) and local sponsor an opportunity to seek corrective measures from the Corps. Also, contracts should have had considerable retainers in the amount of 10% or higher and not be paid until the federal and NFS are satisfied that the contract is complete and finished according to plans and specifications.

A second hardship was caused by the division of the HSDRRS projects between the Hurricane Protection Office (HPO) and the Protection and Restoration Office (PRO). There were inconsistencies in

construction practices and design waivers such as the use of uncoated steel piles and the lack of cathodic connectivity between piles. An expert review panel on the Greater New Orleans HSDRRS design guidelines concurred that the use of sacrificial steel is not a good practice in this region (see attachment 1). Most of these issues occurred on the LPV projects managed by the HPO office and will arguably add maintenance costs over the life of the projects. For consistency, all future projects should be operated out of one office.

Some well-intended specification changes created other hardships. In order to build stronger earthen levees, the soil specification was changed to increase the clay content and reduce the organic content. This created a problem in establishing a grass cover on the levees, because the clay was too hard to allow the root mass to become established and the soil did not contain enough organic material to encourage growth. This became a problem because levees without grass cover are susceptible to erosion during rain events. In some cases, the contract was considered complete without adequate turf establishment. The projects were turned over to the NFS or the Corps had to take corrective measures with hired labor forces. This wound up costing more time and money. Specification changes should be vetted by the NFS prior to wholesale changes.

In conclusion, the WBV is better prepared against storm surge from tropical events. The West Closure Complex has closed the entry point of storm surge into the Harvey and Algiers Canals and has reduced potential flooding in these basins. The cost to Operate, Maintain, Repair, Rehabilitate and Replace (OMRR&R) the \$1 billion facility is approximately \$3 Million per year. This is a heavy burden to the local sponsors without federal participation. Most of the HSDRRS projects are complete with the exception of some project modifications and armoring. The Corps was mandated to provide resiliency to the system for storm events greater than the 100 year storm. The Corps chose to use armoring products to provide this level of resiliency, in lieu of additional height. These armoring products were tested at the University of Colorado and proved to be effective in providing erosion resistance on earthen levees against overtopping events. However, the system is still susceptible to overtopping and flooding will still occur. Depending on the size of the storm, there are homes and places that will flood again. Moreover, the recently awarded armoring contracts have indicated that it will cost as much to armor the levees as it will cost to raise the levees an average height of two feet. The Corps has also indicated the future costs to lift and armor the levees will be the responsibility of the NFS and local sponsors. Future costs to lift and armor levees should be cost shared between the Corps and NFS. We are hopeful that recent mandates in the 2014 WRRDA bill will bring some relief as the local sponsors begin to OMRR&R the WBV projects.

If you have any questions or need any additional information, please feel free to contact me at 504-432-7741 or by email at jmonzon@sifpaw.org. Thank you for the opportunity to provide this testimony.

Senator VITTER. Thank you very much, John. Now we'll hear from Todd Murphy.

STATEMENT OF TODD P. MURPHY, PRESIDENT, JEFFERSON CHAMBER OF COMMERCE

Mr. MURPHY. Thank you. Good morning, Senator Vitter—

Senator VITTER. Good morning.

Mr. MURPHY [continuing]. And members of the Committee on the Environment and Public Works and, of course, the public, that have come out to this beautiful facility.

My name is Todd Murphy, and for the last 3 years, I've served as President of the Jefferson Chamber of Commerce. As Senator Vitter mentioned, we represent businesses in the largest parish in the region, centrally located, in the middle of the region, and we represent the largest number in terms of population; number of businesses and number of jobs.

As a lifelong resident of Jefferson Parish, I can attest to the climate of work and life before, during and, of course, after Hurricane Katrina. We thought we had stress every day, from everyday work routines and everyday challenges of life. Then comes a nearly 60-day evacuation, for most, from the area and many more months and years of inconvenience and aggravation to the life in which we knew.

The people and businesses of the region simply prevailed through the adversity, and many got very creative in how to reopen business to best serve the public.

[Off microphone] a professional banker at the time, our bank joined two dozen other banks to jointly open in locations that met the usually basic requirements of safety, accessibility, electricity, and, of course, air conditioning, which is necessary in mid-September in south Louisiana.

Approved by the Louisiana Office of Financial Institutions and supported by local, State and Federal regulatory and security agencies, 14 locations were opened in our parish, each housing three to five respective banks.

So a bank branch opened and operated at Bank A, and, for example, each teller line was a different bank. You had a Bank A, a Bank B, Bank C, Bank D, and we did this throughout the parish. Proper marketing was done through radio and signage to make sure all customers were properly provided for. This went on for about 4 weeks and was certainly an example of collaboration at its best.

And I mention this because today, as we continue to watch storms and prepare for storms, industries like banking, like health care, like financial services, are all still collaborating and working to be prepared, working through our Chamber of Commerce in Jefferson Parish and other regional organizations to be prepared and to collaborate through these potential storms.

In fact, as we would see in the years to come, our area would rely on collaboration, as noticed above, and, of course, the resiliency of its people. And the result has been an evolution of stronger, more efficient businesses built with loyal and passionate employees.

The number of restaurants in our areas alone has more than doubled, and tourism and air travel have reached their respective

numbers, before Katrina. Retail, services and manufacturing are all strong.

We still have storm threats, and as most recent as 2012, a 5-day evacuation. Yet, today we have more confidence in the levee system that has been rebuilt and understand the need to do more for the coastal communities.

Water management is actually now Southeast Louisiana's second largest industry sector, which has added more jobs than any other sector since 2010. The State of Louisiana and Greater New Orleans have been more proactive around the resiliency issue than perhaps any other region in the country.

Moreover, a few points on this resiliency. Resiliency is an existential issue. Without proactive strategies to manage and combat environmental threats, the post-Katrina gains in the Greater New Orleans area from new real estate developments to jobs and industry will be lost.

Ecosystem restoration is economic development. Diversifying an economically promising industry sector is arising from local firms' constant response to local disasters.

And finally, the success of Greater New Orleans equates to the success of the Nation. At the mouth of the Mississippi River, supporting one of the Nation's largest deltas and most significant energy strongholds, Greater New Orleans strengths and weaknesses are felt nationally.

As a clear outcome of the extraordinary manmade and natural disaster of the last decade, Greater New Orleans serves as a model for the country in innovative policies, plans, leadership, work force and industry development, and infrastructure investment around resiliency.

In fact, Louisiana-based firms have received over \$327 million in State and Federal prime contracts related to Hurricane Sandy response, recovery and rebuilding.

I'd like to close by thanking Senator Vitter for this forum and members of the Senate Committee on Environment and Public works for allowing me to testify today on such short notice.

It is critically important for the businesses and residents of this region and Louisiana to have adequate protection against catastrophic storms and storm surge so that we're able to foster and grow a vibrant local and State economy.

Thank you very much.

Senator VITTER. Great. Thank you, Todd, very much. And next we'll hear from Bob Turner, Regional Director of the Southeast Louisiana Flood Protection Authority—East. Bob, thanks.

STATEMENT OF ROBERT A. TURNER, P.E., CFM, REGIONAL DIRECTOR, SOUTHEAST LOUISIANA FLOOD PROTECTION AUTHORITY—EAST

Mr. TURNER. Good morning, Chairman Vitter.

Senator VITTER. Good morning.

Mr. TURNER. Thanks for the opportunity to be here today to talk about our flood defense system in advance of this year's hurricane season, and also, you know, personally, I want to thank you for being such a strong advocate for flood protection in our area.

The new Federal levee system is far better than the system we had before Hurricane Katrina, and today I'm happy to report that it is being well-maintained and it is in good condition.

But to keep the system performing to the level authorized by Congress, there is still plenty of work that needs to be done. You see, our levees were designed to be periodically lifted to sustain required elevations through the life of the project.

In a Corps memorandum, General Peabody wrote, and I quote, "Without additional levee lifts, the expected consolidation, settlement and subsidence and sea level rise will cause levee reaches within the system to fall below the required elevation necessary to provide 1 percent risk reduction as early as 2016." And he went on to say that the system will no longer meet NFIP accreditation criteria when the first levee reach settles below the required elevation.

Now, it's important to note that the Project Partner Agreement, signed by the Corps and the non-Federal sponsor, excludes such lifts from the maintenance responsibilities of the non-Federal sponsor. So it certainly stunned local partners when Corps attorneys claimed existing law did not allow the Corps to construct periodic levee lifts and share the cost with local partners, as had been done historically by the pre-Katrina Federal levee system.

Surely, it was not the intent of Congress or the Corps to build a \$14 billion Federal levee system such that it would provide the authorized level of protection for less than 5 years.

More recently, provisions were included in WRRDA 2014 to address this critical issue. It authorizes the Corps to construct periodic levee lifts with a 35 percent non-Federal cost share, provided a General Re-Evaluation Report, or GRR, finds that the work is technically feasible, environmentally acceptable and economically justifiable.

It is imperative that the GRR be completed as soon as possible, but we realize that Corps reports and congressional appropriations take time. But some of our levee segments in the system will fall below authorized heights within the next 2 to 3 years.

So we are considering lifting some levee segments in advance of the Corps armoring effort to both maintain the required levee heights and avoid wasting tens of millions of dollars on armoring that must be removed and replaced as part of any levee lift.

We would ask, at least, to receive project credits for the local funds that we use to lift those levees, before the required the Corps report is complete, and Federal funds can be appropriated for the needed lifts.

WRRDA 2014 also designates responsibility to the Corps to operate and maintain the sector gate and barge gate across the Gulf Intracoastal Waterway, at the surge barrier, with a 35 percent cost share for the non-Federal sponsor. But the Corps has informed us that they will not begin operating and maintaining those structures until funds have been appropriated for that purpose.

So in the absence of the Corps, we are taking care of those facilities for the time being. Local funds expended to fulfill the Federal responsibility to operate and maintain and repair those structures should be reimbursed by the Corps to the non-Federal sponsor, or

at least used to offset the 35 percent cost share required for the future work.

Our new system is definitely large and most definitely complicated, so it's not unusual for engineers to occasionally disagree on complex design decisions.

For example, early in the design phase, the St. Bernard Parish T-walls, our non-Federal project team expressed concerns regarding the adequacy of the Corps design, of the steel pile foundation elements. But the Corps chose to proceed with construction without modifying that design.

Then after completing construction, the Corps took a much more detailed look at that entire design, and although it has been determined that there is no immediate danger to the integrity of the T-walls, the Corps' latest analysis indicates that problems with steel piles could develop in the future.

So their current plan is to install monitoring equipment at multiple locations along the 23-mile floodwall to measure corrosion rates and the stresses in the steel pile foundation elements.

A robust monitoring program will allow for advance notice of developing problems so that plans and funding can be put in place to correct any design deficiencies.

And we agree that a monitoring program is needed, but we believe the Corps should be responsible for operating and maintaining the monitoring equipment and collecting and analyzing that data. Such costs and responsibilities should not be transferred to the non-Federal sponsor.

So in closing, first of all, I would like to thank you and your staff for all the hard work and attention you have given to reducing flood risk in our region, and thank you for allowing me the opportunity to provide this testimony.

There's far more detail and supporting documentation in my written remarks, and I look forward to answering any questions you may have and assisting the committee in any way that you might find helpful. Thank you.

[The prepared statement of Mr. Turner follows:]

WRITTEN TESTIMONY

OF

**ROBERT A. TURNER, P.E., CFM
REGIONAL DIRECTOR
SOUTHEAST LOUISIANA FLOOD PROTECTION AUTHORITY – EAST**

BEFORE THE

**SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE**

HEARING ENTITLED:

PROVIDING NECESSARY FLOOD PROTECTION TO PROTECT COASTAL COMMUNITIES

MAY 15, 2015

9:30 AM – NEW ORLEANS LAKEFRONT AIRPORT WALNUT ROOM

Chairman Vitter, Ranking Member Boxer, and members of the Committee,

Welcome to New Orleans and thank you for the opportunity to testify before you today. My name is Robert A. Turner, and I am a registered professional engineer with over thirty years of experience in Civil and Structural design. I am the Regional Director of the Southeast Louisiana Flood Protection Authority – East (SLFPAE), which was created after Hurricane Katrina to bring regional, professional management to levee districts in the metropolitan New Orleans area. Our Board includes four registered professional engineers and two coastal scientists, providing specialized expertise from beyond the borders of our State. I was Executive Director of the Lake Borgne Basin Levee District when Hurricane Katrina devastated that community in 2005, and later served as a member of the National Committee on Levee Safety.

Since SLFPAE's inception in 2007, we have been fully engaged with the US Army Corps of Engineers (USACE) and the Louisiana Coastal Protection and Restoration Authority (CPRA) during the planning, design and construction of the Hurricane and Storm Damage Risk Reduction System (HSDRRS) for the metropolitan New Orleans area. Much has been accomplished in the years since Katrina. A \$14 billion civil works project designed to reduce hurricane storm surge risk in the New Orleans area has been substantially completed in less than seven years. Many dedicated individuals working for the Corps, the State of Louisiana, and local levee districts have worked tirelessly to make this happen. It serves as a testament to what our nation can accomplish when such projects are fully funded up front. Our nine member Board of Commissioners wants to again thank Congress and the American taxpayers for recognizing the importance of Greater New Orleans to the nation and for providing the funds necessary to complete the work.

Our nation's coasts are substantially more crowded than the US as a whole, and growing more so every year. More than 40 percent of our country's population already lives in what FEMA identifies as Coastal Shoreline Counties representing less than 10 percent of the U.S. land area (excluding Alaska). And by 2030, that estimate will have climbed from 120 million to 150 million or so coastal residents. Americans continue to be drawn in droves to their coastal cities – most of which are also important ports that provide access to and from the interior via a river. In addition to the lure of good jobs, great transportation and economic opportunities, life along great water bodies offer a wealth of fisheries, recreation and water-driven tourism. But from the Eastern Seaboard south to Miami Beach, from Melbourne to New Orleans, Houston and Galveston, and right on up the West Coast to San Diego, Los Angeles and San Francisco, global sea

level is rising at an accelerated rate, and as a result, greater levels of storm surge and flooding threaten our densely populated coastal communities.

A 2014 study at the University of North Carolina-Chapel Hill School of Government took a close look at the fallout from just Hurricane Katrina in 2005 and Super Storm Sandy, a post-tropical cyclone by the time it slammed into New Jersey in 2012. Their numbers tell the tale that we cannot allow ourselves to forget: more than 2,000 Americans dead; 244,000 jobs permanently lost; \$180 billion in property lost; and incalculable misery and grief. We simply must do a better job protecting our coastal communities from the consequences of increasing coastal flooding.

The process of planning, designing, constructing, operating and maintaining coastal flood defenses is complex and usually involves partnerships between local non-federal sponsors and USACE. Based upon my experiences partnering with USACE on the HSDRRS Project the last eight years, I offer the following information, insight.

SUSTAINING CONGRESSIONALLY AUTHORIZED LEVELS OF RISK REDUCTION

Coastal areas of Southeast Louisiana are mostly comprised of soft, deltaic compressible soils. Because of the natural subsidence associated with these weak soils, coupled with the global incidence of sea level rise, levee construction in this region historically requires periodic lifts over time to sustain authorized levels of risk reduction.

Authorizations for the pre-Katrina Lake Pontchartrain and Vicinity Hurricane Protection Project (LPVHPP) dating back to 1965 included post construction periodic levee enlargements, or "lifts". The costs of the lifts was shared between the federal government and the non-federal sponsor. Prior to 2005, some segments of the LPVHPP were lifted multiple times using the original project cost share ratio.

Soon after Katrina, USACE began planning the new HSDRRS. In order to build a project with a 50-year design life that took into account both anticipated subsidence and sea level rise, USACE decided to design hardened structures, such as floodgates and concrete floodwalls, to the elevations required to provide the authorized level of risk reduction through 2057. As for the new levees, they were designed and constructed to provide the authorized level of risk reduction only for the near-term - in some cases, as little as two years. Doing so allowed for lower project costs, a shorter construction time and fewer environmental impacts. This decision was premised on the belief of Corps officials and the local sponsor that USACE would continue the historic practice of building and helping pay for the successive levee lifts that would be needed over a number of years to offset subsidence and sea level rise.

However, several years into the design of the system, USACE lawyers advised that the authorizing acts for the HSDRRS [Public Law 109-234 – Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, in June of 2006, (4th Supplemental) and Public Law 110-252 – Supplemental Appropriations Act, in June 2008 (6th Supplemental)] contained no provision for the continued federal participation in the successive levee lifts required, after initial construction, to complete the levees and keep them at authorized heights.

Several years into the design of the system, USACE lawyers advised that the authorizing acts for the new work [Public Law 109-234 – Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, in June of 2006, (4th Supplemental) and Public Law 110-252 – Supplemental Appropriations Act, in June 2008 (6th Supplemental)] contained no provisions for federal participation in post initial construction levee lifts needed to sustain the Project's authorized level of risk reduction.

The cost of periodically lifting the levees was never intended to be borne exclusively by the non-federal sponsor as an Operation, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) responsibility. Article II E of the Project Partnering Agreement between the Department of the Army and the Coastal Protection and Restoration Authority of Louisiana for the Lake Pontchartrain and Vicinity, Louisiana Project dated 22 September 2008 clearly states:

... "Nothing in this Agreement is intended to require the Non-Federal Sponsor to perform future measures to restore the New Work to the authorized level of protection to account for subsidence or sea level rise as part of its OMRR&R responsibilities."

In a Memorandum for HQUSACE (CECW-ZA/MG Walsh), Wash DC 20314-1000, dated 25 April 2012 [reference attachment 1], General Peabody states:

- *"Without additional levee lifts, the expected consolidation, settlement, subsidence, and sea level rise will cause levee reaches within the system to fall below the required elevation necessary to provide 1 percent risk reduction as early as 2016. The HSDRRS will no longer provide 1 percent risk reduction or meet NFIP accreditation criteria when the first levee reach settles below the required elevation."*
- *"The Corps does not have authorization or funding for future levee lifts. The current total estimated cost of future levee lifts projected through 2057 is \$820 million (2010 dollars). The enclosed white paper and STRATCOM*

have been developed to allow the Administration and Congress to be informed of the need for authority and funding to sustain the HSDRRS at the 1 percent level of risk reduction.”

Levee elevations within our jurisdiction were surveyed by SLFPAE in December 2014. Those measurements showed that some segments within our system are at HSDRRS required design elevations now and confirmed that several will fall below the necessary elevation to provide the authorized level of protection by 2016. **Surely, it was not the intent of Congress to have USACE design and build the \$14 billion HSDRRS such that it would provide the authorized level of protection for less than five years?**

More recently, provisions included in Section 3017 of the *Water Resources Reform and Development Act of 2014 (WRRDA 2014)* were an effort to address this critical issue. It authorized the Secretary of the Army to carry out measures that address consolidation, subsidence, sea level rise, and new datum to restore certain federally authorized hurricane and storm damage risk reduction projects to their authorized levels of protection if the Secretary determines through a project-specific general reevaluation report (GRR) that the measures are:

- Technically feasible
- Environmentally acceptable
- Economically justifiable

USACE Implementation Guidance dated 03 December 2014 [reference attachment 2] indicates that the “normal budget process will be followed when requesting funds to initiate a project-specific GRR pursuant to Section 3017.” **Therefore, we request that Congress provide the required funds to finish the required GRR as soon as possible and appropriate the needed funds to maintain the authorized level of risk reduction for the metropolitan New Orleans Area.**

It is obvious that some segments of our system will fall below the elevation required to provide the authorized level of risk reduction before the GRR can be completed. And to complicate matters, the Corps has already begun to armor HSDRRS levees to prevent scour and breaching that could occur during an overtopping event. But the material selected for armor cannot be left in place when the levee segment is lifted. If the levee segments undergoing rapid subsidence are armored before being lifted, the armor will have to be removed and replaced with new armor when the levees are finally raised in the very near future. Thus the tens of millions spent on the original armoring effort will be lost.

Consequently, SLFPAE wants some levee segments that are experiencing rapid subsidence lifted before they are armored, and we have committed local funds to pay

for this work. We believe it is imperative to do so to maintain the authorized level of protection and to avoid wasting many millions of dollars on armor with a very short useful life.

USACE has indicated that the local funds expended in this effort may not be creditable as part of the total HSDRRS Project cost. And federal cost sharing is not an option until completion of the GRR. But as stated earlier, lifting levees to account for subsidence and sea level rise is not part of our OMRR&R responsibilities as outlined in the Project PPA. **We firmly believe any funds we expend on lifting levee segments to sustain the Project's authorized level of protection before completion of the USACE GRR should ultimately be creditable, and we ask for your guidance and continued assistance in this matter.**

FEDERAL RESPONSIBILITIES UNDERTAKEN BY NON-FEDERAL INTERESTS

Section 2013 of the *Water Resources Reform and Development Act of 2014 (WRRDA 2014)* designates the responsibility to operate maintain and repair “any flood gate , as well as any pumping station constructed within the channel as a single unit with that flood gate, that –

- a) *was constructed as of the date of enactment of the Water Resources Reform and Development Act of 2014 as a feature of an authorized hurricane and storm damage reduction project; and*
- b) *crosses an inland intracoastal waterway described in Section 206 of the inland Waterways Revenue Act of 1978 (U.S.C. 1804).”*

It also specifies that the non-federal share of the cost shall be 35 percent.

Recent USACE Implementation Guidance dated 24 November 2014 [reference attachment 3] acknowledges federal responsibility but indicates that no funds have been appropriated for the purpose. The guidance document states “... funds for O&M are provided on an annual basis and, therefore, O&M in any given year would be subject to the availability of funds for this purpose”. Consequently, USACE has not begun operating and maintaining the facilities as authorized in Section 2013.

In the absence of USACE, SLFPAE is using local funds to operate, maintain and repair the barge and sector gates crossing the Gulf Intracoastal Waterway to ensure the integrity of the HSDRRS. Failure to do so would render the HSDRRS ineffective and place the citizens of our region at great risk. Yet, USACE has indicated that we cannot apply our costs for fulfilling this federal responsibility toward the 35% non-federal cost share requirement until the Project Partnership Agreement for the Project is amended.

And local Corps leadership says that work on an amended PPA cannot even begin until Congress appropriates funds for the authorized O&M.

We believe any local funds expended to fulfill the federal responsibility to operate, maintain and repair these structures should be reimbursed by USACE to the non-federal sponsor, or used to offset the 35% cost share required for future work.

DESIGN ISSUES

It is not unusual for engineers to occasionally disagree on decisions made during the design of large complex public works projects affecting the safety and welfare of the public. For example, early in the design phase for the HSDRRS T-Walls located in St. Bernard Parish, the non-federal project team expressed concerns regarding the adequacy of the steel pile foundation elements. Specifically, we cautioned against using uncoated steel because of potential corrosion issues and pointed out that using battered piles in soils subject to high settlement rates could cause unanticipated loads on the piles substantial enough to overstress the steel. The Corps chose to construct the project before fully investigating and addressing our concerns.

Several years after construction was completed, and after extensive research, numerical analysis and physical scale modeling, USACE agreed that there is reason for concern. Although there is no immediate danger to the integrity of the T-Walls in St. Bernard Parish, the Corps' latest analysis indicates that problems with the steel piles could develop in the future.

The Corps' current plan is to install monitoring equipment at multiple locations along the 23-mile floodwall to measure corrosion rates and stresses in the steel pile foundation elements. A robust monitoring program will allow advance notice of developing problems so that plans and funding can be put in place to correct any design deficiencies.

We agree that a monitoring program is needed, but the Corps plans to require the non-federal sponsor to operate and maintain the monitoring equipment and periodically collect, maintain and report the data. We do not agree that this is a non-federal OMRR&R responsibility, particularly since we raised issue with the design long before the wall was constructed.

The stated purpose of the monitoring program is to validate adequacy of the T-Wall and provide data to better inform design decisions for similar structures on other future projects. Consequently, we believe USACE should be responsible

for operating and maintaining the monitoring equipment, and collecting, maintaining and analyzing the data on a frequent basis.

In closing, I would like to once again thank all the members of the Committee for allowing me the opportunity to provide this testimony. I hope the information provided will be helpful in your work. I look forward to answering any questions you may have and assisting the Committee in any way that you might find helpful. I can be reached by phone at (504)-280-2411, or by email at rturner@slfpae.com.

Respectfully submitted,

Robert A. Turner, P.E., CFM
Regional Director
Southeast Louisiana Flood Protection Authority - East

Attachments:

Attachment 1 – Memorandum for HQUSACE, dated 25 April 2012

Attachment 2 – Memorandum for Commander, Mississippi Valley Division,
dated 03 December 2014

Attachment 3 – Memorandum For Commander, Mississippi Valley Division,
dated 24 November 2014

Attachment 1



DEPARTMENT OF THE ARMY
 MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
 P.O. BOX 80
 VICKSBURG, MISSISSIPPI 39181-0080

REPLY TO
 ATTENTION OF:

CEMVD-PD-N

25 April, 2012

MEMORANDUM FOR HQUSACE (CECW-ZA/MG Walsh), WASH DC 20314-1000

SUBJECT: Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS), Continued System Assurance - Future Construction, Levee Lifts

1. References:

a. Memorandum, CECW-MVD, 16 March 2011, SAB, which provided policy guidance for future construction of levee lifts and measures needed to sustain the capability of the greater New Orleans HSDRRS.

b. HSDRRS In-Progress Review to HQUSACE, 17 November 2011. Mr. Stockton provided verbal direction to prepare a White Paper, thus rescinding the direction outlined in the 16 March 2011 memorandum.

2. The New Orleans District is scheduled to complete construction later this year on the Lake Pontchartrain and Vicinity and West Bank and Vicinity projects to provide levels of protection necessary to achieve the certification required for participation in the National Flood Insurance Program (NFIP) under the base flood elevations current at the time of this construction.

3. Without additional levee lifts, the expected consolidation, settlement, subsidence, and sea level rise will cause levee reaches within the system to fall below the required elevation necessary to provide 1 percent risk reduction as early as 2016. The HSDRRS will no longer provide 1 percent risk reduction or meet NFIP accreditation criteria when the first levee reach settles below the required elevation.

4. The Corps does not have authorization or funding for future levee lifts. The current total estimated cost of future levee lifts projected through 2057 is \$820 million (2010 dollars). The enclosed White Paper and STRATCOM have been developed to allow the Administration and Congress to

CEMVD-PD-N

SUBJECT: Greater New Orleans Hurricane and Storm Damage
Risk Reduction System (HSDRRS), Continued System Assurance -
Future Construction, Levee Lifts

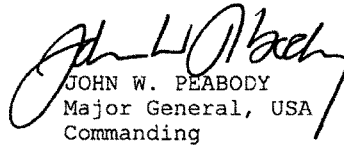
be informed of the need for authority and funding to sustain
the HSDRRS at the 1 percent Level of Risk Reduction.

5. At this time, no further action will be taken in
response to CECW-MVD memorandum dated 16 March 2011.

6. Our POC for this action is Ms. Julie LeBlanc,
CEMVD-PD-N, (601) 634-5064.

Building Strong!

Encls


JOHN W. PEABODY
Major General, USA
Commanding

CF:
CEMVN-EX

Attachment 2

REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

DEC 03 2014

CECW-P

MEMORANDUM FOR COMMANDER, Mississippi Valley Division (CEMVD-PD)

SUBJECT: Implementation Guidance for Section 3017 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) – Rehabilitation of Existing Levees

1. Section 3017 of WRRDA 2014 authorizes the Secretary of the Army to carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore certain federally authorized hurricane and storm damage reduction projects to their authorized levels of protection, if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified. This authority applies only to those projects constructed as of the date of enactment of WRRDA 2014 and for which the executed project partnership agreement (PPA) provides that the non-federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of the operation, maintenance, repair, replacement, and rehabilitation responsibilities. In addition, Section 3017 specifies that cost sharing associated with measures carried out under this authority shall be determined as provided in subsections (a) through (d) of Section 103 of the Water Resources Development Act of 1986. Further, Section 3017 includes a reporting requirement. Finally, the authority terminates 10 years after the date of enactment of WRRDA 2014. A copy of Section 3017 is enclosed.
2. The projects covered by Section 3017 include Lake Pontchartrain and Vicinity, Louisiana Project (PPA executed 22 September 2008) and West Bank and Vicinity, Louisiana Project (PPA executed 6 November 2008).
3. A project-specific general reevaluation report (GRR) must be prepared to determine if the measures necessary to restore the project to its authorized level as a result of consolidation, settlement, subsidence, sea level rise, and new datum are technically feasible, environmentally acceptable and economically justified. The normal budget process will be followed when requesting funds to initiate a project-specific GRR pursuant to Section 3017. Upon receipt of initial funding, a feasibility cost sharing agreement will be executed and a scope of work and schedule will be developed utilizing the SMART Planning principles and submitted to the vertical team for review and concurrence. The GRR will be cost shared 50/50 between the Corps and non-federal sponsor. The GRR will be processed in accordance with Appendix H of ER

CECW-P

SUBJECT: Implementation Guidance for Section 3017 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) – Rehabilitation of Existing Levees

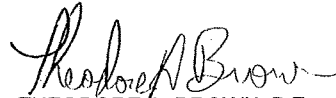
1105-2-100 and provided to the Mississippi Valley Division and Corps Headquarters (Attn: CECW-MVD) for review and processing to the Assistant Secretary of the Army (Civil Works) for approval.

4. Cost sharing of hurricane and storm damage reduction measures carried out under this authority is 65 percent federal / 35 percent non-federal. The costs of operation, maintenance, repair, replacement and rehabilitation of the measures carried out under Section 3017 are a 100 percent non-federal sponsor responsibility.

5. Not later than 10 June 2019, the ASA(CW) is required to include in the annual report prepared pursuant to Section 7001 of WRRDA 2014 any recommendations relating to continued need for this authority; a description of measures carried out; any lesson learned related to measures implemented; and best practices for carrying out measures to restore hurricane and storm damage reduction projects. In order to meet this requirement, the Division Commander must submit the required information, including any recommendations, to the MVD RIT by 15 September 2018.

6. The authority to carry out measures under Section 3017 terminates on 10 June 2024.

Encl



THEODORE A. BROWN, P.E.
Chief, Mississippi Valley Division
Regional Integration Team
Directorate of Civil Works

CECW-P

SUBJECT: Implementation Guidance for Section 3017 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) – Rehabilitation of Existing Levees

SEC. 3017. REHABILITATION OF EXISTING LEVEES.

(a) *IN GENERAL.*—The Secretary shall carry out measures that address consolidation, settlement, subsidence, sea level rise, and new datum to restore federally authorized hurricane and storm damage reduction projects that were constructed as of the date of enactment of this Act to the authorized levels of protection of the projects if the Secretary determines the necessary work is technically feasible, environmentally acceptable, and economically justified.

(b) *LIMITATION.*—This section shall only apply to those projects for which the executed project partnership agreement provides that the non-Federal interest is not required to perform future measures to restore the project to the authorized level of protection of the project to account for subsidence and sea-level rise as part of the operation, maintenance, repair, replacement, and rehabilitation responsibilities.

(c) *COST SHARE.*—

(1) *IN GENERAL.*—The non-Federal share of the cost of construction of a project carried out under this section shall be determined as provided in subsections (a) through (d) of section 103 of the Water Resources Development Act of 1986 (33 U.S.C. 2213).

(2) *CERTAIN ACTIVITIES.*—The non-Federal share of the cost of operations, maintenance, repair, replacement, and rehabilitation for a project carried out under this section shall be 100 percent.

(d) *REPORT TO CONGRESS.*—Not later than 5 years after the date of enactment of this Act, the Secretary shall include in the annual report developed under section 7001—

(1) any recommendations relating to the continued need for the authority provided under this section;

(2) a description of the measures carried out under this section;

(3) any lessons learned relating to the measures implemented under this section; and

(4) best practices for carrying out measures to restore hurricane and storm damage reduction projects.

(e) *TERMINATION OF AUTHORITY.*—The authority of the Secretary under this subsection terminates on the date that is 10 years after the date of enactment of this Act.

Attachment 3

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

NOV 24 2014

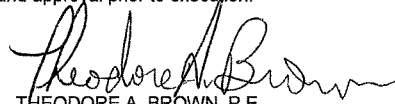
CECW-P

MEMORANDUM FOR COMMANDER, Mississippi Valley Division

SUBJECT: Implementation Guidance for Section 2013 of the Water Resources Reform and Development Act of 2014 (WRRDA 2014) – Operation and Maintenance of Flood Gates on the Fuel Taxed Inland Waterways

1. Section 2013 of WRRDA 2014 provides that the Secretary shall be responsible for the operation and maintenance (O&M), including repair, of any flood gate, as well as any pumping station constructed within the channel as a single unit with that flood gate, that was constructed as of the date of enactment of WRRDA 2014 as a feature of an authorized hurricane and storm damage risk reduction project and crosses an inland or intracoastal waterway as described in section 206 of the Inland Waterways Revenue Act of 1978 (33 U.S.C. 1804). The non-federal share of the cost of operation, maintenance, repair, rehabilitation, and replacement of any structure pursuant to this authority shall be 35 percent.
2. While section 2013 provides that the Secretary is responsible for the O&M, including repair, of certain flood gates and pumping stations, no funds have been appropriated for this purpose. Further, funds for O&M are provided on an annual basis and, therefore, O&M in any given year would be subject to the availability of funds for this purpose. However, recognizing the potential consequences if these structures are not operated as required for hurricane and storm damage reduction, every consideration will be given in the formulation of future budget requests to include the federal share of the O&M funding.
3. The following flood gates and pumping stations are covered by section 2013: the Inner Harbor Navigation Canal Surge Barrier project (barge and sector gates crossing the Gulf Intracoastal Waterway (GIWW)); West Bank and Vicinity project - GIWW Western Closure Complex sector gates, sluice gates, and pump station; and sector gates and pump station on the Harvey Canal.
4. The project partnership agreements for the projects covered by this section may be amended to recognize that the Secretary will undertake operation and maintenance, including repair, of the covered floodgates and pumping stations to the extent that funds are available for that purpose and the non-Federal sponsor has provided its cost share. The draft amendment must be submitted to HQUSACE for review and approval prior to execution.

Encl


THEODORE A. BROWN, P.E.
Chief, Planning and Policy Division
Directorate of Civil Works

CECW-P

SUBJECT: Implementation Guidance for Section 2013 of the Water Resources Reform and Development Act of 2014 – Operations and Maintenance of Flood Gates on Fuel Taxed Inland Waterways

SEC. 2013. OPERATION AND MAINTENANCE OF FUEL TAXED INLAND WATERWAYS.

Section 102 of the Water Resources Development Act of 1986 (33 U.S.C. 2212) is amended —

- (1) by redesignating subsection (c) as subsection (d); and
- (2) by inserting after subsection (b) the following:

(c) Floodgates on the inland waterways

(1) OPERATION AND MAINTENANCE CARRIED OUT BY THE SECRETARY. - Notwithstanding any other provision of law, the Secretary shall be responsible for the operation and maintenance, including repair, of any flood gate, as well as any pumping station constructed within the channel as a single unit with that flood gate, that —

“(A) was constructed as of the date of enactment of the Water Resources Reform and Development Act of 2014 as a feature of an authorized hurricane and storm damage reduction project; and

“(B) crosses an inland or intracoastal waterway described in section 206 of the Inland Waterways Revenue Act of 1978 (33 U.S.C. 1804).

(2) NON-FEDERAL COST SHARE

The non-Federal share of the cost of operation, maintenance, repair, rehabilitation, and replacement of any structure under this subsection shall be 35 percent.

Senator VITTER. Great. Thank you, Bob, very much. And last, but certainly not least, we'll hear from Dr. Shirley Laska.

**STATEMENT OF SHIRLEY LASKA, PH.D., PROFESSOR EMERITA,
UNIVERSITY OF NEW ORLEANS**

Ms. LASKA. We social scientists always feel comfortable being last, so it's all good. Thank you, Senator Vitter, and the Environment and Public Works Committee for allowing me to make some comments this morning.

Achieving better risk reduction from flooding for America's coastal communities is a goal that can never be taken seriously enough. Coastal areas vary in flood risk, but each coastal community's safety is critical because so many societal services and activities occur there and such large numbers of our citizens live within coastal communities.

The takeaway from my brief comments is that each coastal area of interconnected communities must recognize the portfolio of efforts available to them to reduce their risk to flooding and must invest their time, energy and financial resources into these efforts.

The second part of the takeaway is that the portfolio must be implemented as part of a system of risk reduction, not as separate activities, and we must grow as a society in understanding how the pieces fit together for the best risk reduction and how each of us can play a role.

I know you are familiar with the idea of a system of protection. The Colonel was, of course, speaking about it this morning. We used to consider our system just one levee and all of its needed parts, the types of materials to construct it, the shape of it, the surface protection materials. We have improved our understanding of systems since Hurricane Katrina.

Now the Corps is working to implement risk reducing systems that include multiple levees, flood walls and pumps, how they function together, and are now even adding non-structural methods into their systems.

St. John and St. James Parishes, and Calcasieu Parish, in west Louisiana, are all participating with the Corps in planning projects that include elements other than large levees—such as ring levees around clusters of houses, culvert flaps to prevent back flow flooding, some home buyouts and elevating structures.

Where the social scientists specializing in supporting flood risk reduction come in is to “flesh in” the system idea to include multiple activities that, taken together, thought about together, modified in conjunction with one another, create safer coastal communities.

A recent report published by the National Academy of Science gives us a clear picture of what this idea means; “There is a clear need for a comprehensive, tailored approach to flood risk management behind levees”—and I would change that to say “in conjunction with levees”—“that is designed and implemented at the local level, it involves Federal and State agencies, communities, and households, takes into account possible future conditions, and relies on an effective portfolio of structural measures, nonstructural measures, and insurance to reduce the risk to those behind levees.”

Of course, in this area, we would also include coastal restoration in that list.

Unfortunately, we are a long way from achieving what is recommended by this study. Levees give us too much confidence that they are all that needs to happen and too much confidence that we have levees high enough to give us excellent protection. This complacency is called “the levee effect.”

The protection of our New Orleans levee system today is 1 percent risk per year, as you have heard the others say. That gives us a 26 percent chance of flooding in the course of a 30-year mortgage. Even though we know these odds are still very seriously high, the warning falls back into our consciousness to a real small corner of our thinking and we simply get on with what’s happening here and now. I think the Colonel called it “complacency.”

Those who are going to survive the next flood most effectively are those who don’t let that happen. All of us in this room who are “locals” treasure Angelo Brocato’s Italian Ice Cream and Pastry. The store was badly flooded in Hurricane Katrina. The current owner, Mr. Brocato, II, can’t elevate his store on Carrollton Avenue because it is an historic building in a row of such.

During a recent Walk and Learn event, held by the Building Resilience Workshop and the Stay Local Small Business Organization, Mr. Brocato shared his knowledge of flood insurance—how much to buy, what it will cover—and what he can do to protect his equipment beyond insurance, elevating it as much as possible and moving what he can’t into air-tight walk-in freezers. These efforts will enable him to be resilient.

Mr. Gerry Fullington, the manager of Massey Sporting Goods store, on North Carrollton Avenue, on the Lafitte Corridor, also told the Walk and Learn group that his resiliency focuses on several activities: First, he always keeps his suppliers paid in full so that when he needs them to send replacement inventory quickly after a flood, they will. He also has a robust online business that will sustain the company while the stores are rebuilt the next time they flood.

And finally, in the same neighborhood, the manager of the Gulf Coast Bank, Mr. Eric van Hoven, described how his staff shows all of the bank’s clients how to do all of their business with the bank electronically so that when another flood occurs, the customers will be able to take advantage of the bank’s full electronic banking services.

Just these brief examples show the variety of risk reducing activities that three regular citizens of New Orleans have honed to reduce their business risks. They are paying attention to risk reduction, not letting it recede into their thinking and they have committed themselves to integrate different measures and to being part of the system of risk reduction in New Orleans.

The president of the Greater Mid-City Merchants Association, Mr. Tim Levy, supported the Walk and Learn. We are hoping that such a co-teaching event will expand risk reduction commitments for all of their business owners so that when—and I didn’t say “if,” but I said “when”—another disaster occurs, the headline of The Advocate and The Times Picayune newspapers will read: “Mid City

Businesses; Some of the First to Return in Large Numbers.” A similar goal exists for all business areas in the region.

So creating a system of risk reduction effort for a metropolitan area is not rocket science. But unfortunately it is more difficult to achieve. We, as a society, don’t really believe that we need to engage in it continually. Even we, who live in a metropolitan area that is fraught with flooding challenges and that is at the edge of the most quickly subsiding and inundating coast in the entire world, we do not pay enough continual attention.

I will just read now the other recommended items. They are in my printed presentation, and that will conclude my comments.

We should take extreme care to use post disaster funds very carefully for risk reduction. We should not waste a cent.

We should buy flood insurance. We should monitor Write Your Own companies to encourage agents to promote flood insurance. And, Senator Vitter, I know that’s one of your concerns.

We should monitor banks with federally backed mortgages to require flood insurance on insured homes. That protects the entire community.

We should get Federal subsidy for lower and middle income residents for skyrocketing insurance premium rates, as some of you mentioned earlier.

We should recognize the importance and commit to paying local costs for operation and maintenance of levees. We spoke about that this morning.

We should add additional elevations to the required building elevation. Some communities are doing it, but not enough.

We should discontinue construction of slab-on-grade houses in surge risk areas and dense subdivisions because it’s difficult to elevate them if they get flooded.

We should understand the reasoning and follow the NFIP construction requirements.

We should work toward achieving more safety for critical and public buildings, in terms of elevation, because the funds acquired for rebuilding them will never come to us again.

We should demand and have implemented by the government, and its contractors, efficient and effective post disaster recovery, including mitigation, and that was mentioned this morning.

We should increase community and parish participation in the Community Rating System.

And finally, we should take special consideration of restoring storm-safe housing for lower income residents, those who can the least afford to return because of their income.

So these must all be taken and work together as a system with the residents, with the officials, the Federal level, with the Congress, in order for us to hope to achieve the goal of being able to stay in this place, which all of us so much love. Thank you, Senator Vitter.

[The prepared statement of Ms. Laska follows:]

Providing Necessary Flood Protection to Protect Coastal Communities

Testimony

**Shirley Laska, PhD, Professor Emerita, University of New Orleans
U.S. Senate Environment and Public Works Committee
Field Hearings, May 15, 2015, New Orleans**

Achieving better risk reduction from flooding for America's coastal communities is a goal that can never be taken seriously enough. Coastal areas vary in flood risk. There are different configurations of weather, environmental conditions, changes in the land due to human uses of it and economic and social resources of the residents. But each coastal community's safety is critical because so many societal services and activities occur there and such large numbers of our citizens live within coastal communities.

The take away from my brief comments is that each coastal area of interconnected communities must recognize the portfolio of efforts available to them to reduce their risk to flooding and must invest their time, energy and financial resources into these efforts. The second part of the take away is that the portfolio must be implemented as part of a system of risk reduction, not as separate activities, and we must grow as a society in understanding how the pieces fit together for the best risk reduction and how each of us can play a role.

I know that you are familiar with the idea of a system of protection. We used to call a system just one levee and all of its needed parts—types of materials to construct it, shape of it, surface protection materials, etc. We have improved our understanding of systems since hurricane Katrina when the Corps of Engineers even admitted that the levee systems “were systems in name only.” Now the Corps is working to implement risk reducing systems that include multiple levees, flood walls and pumps, how they function together and are now even adding non structural methods into their systems. St. John and St. James Parishes and Calcasieu Parish in west Louisiana are all participating with the Corps in planning projects that include elements other than large levees -- such as ring levees around clusters of structures, culvert flaps to prevent back flow flooding, some home buyouts and elevating structures.

Where the social scientists specializing in supporting flood risk reduction come in is to “flesh in” the system idea to include multiple activities that taken together, thought about together, modified in conjunction with one another, create safer coastal communities including those that comprise metropolitan New Orleans. A recent report published by the National Academy of Science gives us a clear picture of what this idea means. A National Research Council 2013 report entitled *Levees and Flood Insurance* concludes: “There is a clear need for a comprehensive, tailored approach to flood risk management behind levees [I would change the idea to say “**in conjunction with** levees] that (1) is designed and implemented at the local level; (2) involves federal and state agencies, communities, and households; (3) takes into account possible future conditions; and (4) relies on an effective portfolio of structural measures, nonstructural measures, and insurance to reduce the risk to those behind levees.” And in coastal Louisiana we must add coastal ecosystem restoration as a key component of the risk reduction for all of our coastal communities, especially including those in the metropolitan areas and behind levees.

Unfortunately, we are a long way from achieving what is recommended by this study. Levees give us too much confidence that they are all that needs to happen and too much

confidence that we have levees high enough to give us excellent protection. This complacency is called "the levee effect." The protection of our New Orleans levee system today is 1% risk per year, which gives us a 26% chance of flooding in the course of a 30-year mortgage. Even though we know those odds are still very seriously high, the warning falls back in our consciousness to a small corner of our thinking and we simply get on with what's happening here and now in our lives.

Those who are going to survive the next flood most effectively are those who don't let that happen. All of us in this room who are "locals" treasure Angelo Brocato's Italian ice cream and pastry. The store was badly flooded in Hurricane Katrina. The current owner, Mr. Brocato, the 2nd, can't elevate his store on Carrollton Ave. because it is an historic building in a row of such. During a recent Walk and Learn event held by the Building Resilience Workshop and the Stay Local small business organization, Mr. Brocato shared his knowledge of flood insurance -- how much to buy, what it will cover -- and what he can do to protect his equipment beyond insurance -- elevating it as much as possible and moving what he can't into air-tight walk-in freezers. These efforts will enable him to be resilient.

Mr. Gerry Fullington, the manager of Massey Sporting Goods store on North Carrollton Ave. on the Lafitte Corridor, also told the Walk and Learn group, that his resiliency focuses on several activities: First, he always keeps his suppliers paid in full so that when he needs them to send replacement inventory quickly after a flood, they will. He also has a robust on-line business that will sustain the company while the stores are rebuilt the next time they flood. The Carrollton building itself has structural qualities to permit faster recovery as well as permeable surfaces in front of the building to absorb greater amounts of storm water.

And in the same neighborhood, the manager of the Gulf Coast Bank, Mr. Eric van Hoven, described how his staff shows all of the bank's clients how to do all of their business with the bank electronically so that when another flood occurs the customers will be able to take advantage of the bank's full electronic banking services that do not require a physical location. After a flood they will be able to continue business smoothly until the branches are rebuilt. And his branch has a ground floor that is elevated inside, rather than outside to retain the area's traditional streetscape. It is very attractive. But even if it were not, safety comes before aesthetic. The aesthetic values of our beautiful city must never trump safety considerations. Yet all three of these examples have accomplished both.

Just these brief examples show the variety of risk reducing activities that three regular citizens of New Orleans have honed to reduce their businesses' risk. They are paying attention to risk reduction, not letting it recede in their thinking to that small corner of their brain until a tropical low forms in the Gulf. And they have committed themselves to integrate different measures and to being part of the system of risk reduction in New Orleans. The president of the Greater Mid City Merchants Association, Mr. Tim Levy supported the Walk and Learn. We are hoping that such a co-teaching event will expand risk reduction commitments for all of their business owners so that when, I didn't say if but **when**, another disaster occurs, the headline of the *Advocate* and *Times Picayune* newspapers will read: "Mid City Neighborhood Businesses Some of the First to Return in Large Numbers." A similar goal exists for all business areas of the region.

Creating a system of risk reduction efforts for a metropolitan area is not rocket science. But unfortunately it is more difficult to achieve. We as a society don't really believe that we need to engage in it continually. Even we, who live in a metropolitan area that is fraught with

flooding challenges and that is at the edge of the most quickly subsiding and inundating coast in the entire world, do not pay enough continual attention to it.

Let me complete my testimony with a list of some of the important risk-reducing pieces that we need to REALLY pay attention to in order to achieve what the title of this hearing emphasizes: providing necessary flood protection for coastal communities. I will describe a few and the rest are available in the printed testimony here and which will be posted on the Committee's website.

I've been clear about responsibility. Every person, every level of government and every government agency need to take seriously their personal responsibility to reduce flood risk.

1. When we receive federal funds for recovery and building rehab, our government leaders ought to always treat these resources as "precious" and use them as carefully for the reduction of flood risk as they possibly can. They need to carefully ask and answer, "Within the federal guidelines for their use, how best can we use them for risk reduction?" "How many houses can we elevate that are at most risk? Can we use funds to help provide less expensive risk reduction for homes with shallow flooding that don't need elevation but rather wet or dry flood proofing? Not a cent should be wasted. Kudos to Jefferson Parish and the town of John Lafitte for using their post-Katrina (Lee and Isaac) funds quite well. But we know this is not happening everywhere it should in metro New Orleans and the coastal areas.
2. We need to encourage every resident who owns a home to buy flood insurance and retain it, especially those who live in the Special Flood Hazard Areas. We know that is not happening.
3. And every Write Your Own insurance agent must as part of their contract with the government be expected to robustly encourage and assist homeowners to do so. We know this is not happening. The U.S. General Accounting Office (2007) has been concerned about this. I know Mr. Vitter that you are committed to having WYO companies be more pro active for the administrative fees which their companies get.
4. We need to encourage every bank that administers federally-backed mortgages to follow the law which requires, I repeat requires, the mortgage holders to carry flood insurance if they are located in Special Flood Hazard Areas. We know that is not happening. Insurance is a protection for the entire community to be able to recover; it is not just protection for the individual home. When large numbers of homes in high-risk areas don't have the required insurance, the community as a whole suffers when there is flooding because their recovery is impeded.
5. We need to hold FEMA accountable to achieve a method of subsidy to insurance policy holders who cannot afford the recent threatened dramatic actuarial increases in flood insurance because the removal of coastal communities from the coastal floodplain challenges the businesses that depend on being present on the coast. As recommended by a recent National Research Council report (2015) these subsidies should be accomplished in combination with mitigation funds for the structures so that policy costs go down by virtue of the structure's flood risk being reduced, not just by continuing a subsidy. Unless we, an area seriously affected by these price

increases continues to pay attention to this challenge for Louisiana, a form of insurance subsidy may not be implemented for a long time to come.

6. We also need to pay attention to the operation and maintenance (O&M) of the levees and flood walls that were implemented since Katrina. Just last week the residents of St. Bernard Parish rejected for the second time, a tax to contribute to the operation and maintenance of the St. Bernard Parish levees. These levees are part of the system of levees that protects all of the East Bank of the metropolitan New Orleans area. What went wrong? How can this be? We don't yet understand. But we do know that local communities, and residents, must contribute to the maintenance and operation of our levees or the ability of the levees to continue to contribute to our safety will be compromised. Based on the two votes, we must say, we know that support is not happening for this important component of risk reduction in all the most affected communities. Conversely kudos to the other parishes that have levied a Levee District tax for construction, operations and maintenance of levees.
7. We must follow the building codes to elevate our homes required by the National Flood Insurance Program to protect them from flooding. And we must take seriously why adding a foot or two, called *freeboard*, is important in an area so much at risk to flooding. We are not doing that in most of the metropolitan parishes and communities. Nineteen of the 42 Louisiana communities that participate in the CRS have passed such regulations. Nationally 75% of all CRS communities have done so. Only Slidell and St. James Parish have added freeboard to their building requirements. Kudos to them!
8. We must confront the negatives of slab-on-grade construction that cause run off from fill-elevated homes in dense areas, an action that makes it more difficult for the homeowner to follow the legal requirement to not flood thy neighbor. Additionally, the cost to elevate a slab home if it floods in the future is considerably higher than for pier homes. In areas that are predicted to flood in the next 50 years construction of slab houses should not be allowed. Additionally, with pier elevation, coastal Louisiana communities who participate in the Community Rating System can accrue points for reducing flood insurance premiums. These factors make the argument for pier elevation compelling.
9. We know that building codes are required by the NFIP, which include drain holes at the required height from the ground and in sufficient number around the bottom of elevated homes to keep them safe from pressure on the piers and molding damage. We know we are not doing that carefully and with adequate appreciation by residents and some public officials of why we must do it. Kudos to the New Orleans City Council for supporting the rewriting of the elevation guidelines in the new Comprehensive Zoning Ordinance. And these activities must be blended into a commitment of good risk-reduction land use planning by public officials and preparation of community mitigation plans that are created from community involvement and implemented similarly.
10. We must commit to elevate and design critical and public infrastructure more safely with anticipation of future floods and the possibility that they may become more destructive. Did we add a foot or two of elevation, called *freeboard*, above the required elevation, to our precious public schools that were rebuilt with federal

funds after Hurricane Katrina? By precious I mean, we will **never** be given such a largesse of public school construction funds ever again in the city of New Orleans. No we did not. At least to my knowledge. When I asked I was told that children couldn't climb the steps. Take a ride around the city and just look at the remaining beautiful historical schools and the children bounding down the attractive functional steps. We didn't elevate schools to a safer level. We just didn't do it.

11. We must expect and insist on an efficient and timely implementation process from both the federal and state agencies that manage elevation funds after a disaster where elevation funds come in advance of re-construction funds. This hasn't happened – either after Hurricane Katrina nor Hurricane Sandy. Traumatized survivors deserve fair treatment in the bureaucratic management and implementation of recovery and the ability to contribute to risk reduction. Government agencies and the private contractors they hire should provide a more efficient and effective mitigation assistance program (Laska et al., 2012). We just haven't done it.
12. We must participate fully in the Community Rating System, a program that offers community-wide flood insurance rate reductions for pro-active efforts that the community and its residents do beyond that which is required by the NFIP. Since the passage of the Biggert/Waters Act more communities are participating in the Community Rating System. Kudos to those communities in coastal Louisiana who are not only participating in the CRS but are also joining with neighboring communities and parishes to create continuing learning and implementation meetings, especially for community outreach. The Center for Hazards Assessment, Response and Technology of the University of New Orleans (UNO-CHART) is assisting in the collaboration with funding from the Louisiana Sea Grant. And kudos to a local parish seeking entrance to the CRS, St. Bernard.
13. And not only is UNO CHART assisting local communities and parishes to participate, they are also training the next generation of risk-reduction specialists. Just this spring, in its 13th year of existence, UNO CHART awarded its 100th Graduate Research Assistantship to students training to help in this important effort. Funding for the mitigation projects on which the students work has come principally from FEMA (Kudos to the agency) as well as other agencies such as the Corps, NOAA and HUD. Kudos also to both CHART and LSU Sea Grant for creating these inter-parish collaborations and educating the future risk-reduction specialists. And recently, the entrepreneur center, Propeller, is engaging water management entrepreneurs, many of whom are learning about storm risk reduction.
14. We must consider the needs of all income groups to live in rehabbed and flood-safe homes after major flood disasters. For example, does it make sense to emphasize the rebuilding of private homes when those who are most at risk after a flood are those of lower income because of their lower income? Why don't we take care to make sure that rental properties are assisted with SBA loans and attention from us the citizens and the government to have them retrofitted from future damage so that they too survive the next one? Where do the poor now have to live since Katrina? Either not in the New Orleans metropolitan area – their home just as much as ours, or in risky areas of the metro region in apartments that have a good chance

of being severely damaged when the next flood comes. After Katrina we didn't take those steps carefully either.

So finally, in the "dream reality" of these activities being correctly implemented, we must remember to ask: How do they fit together? What is critical? What needs to be done first? Needs to be done regularly? Needs to have oversight so that it is done well? How do the pieces fit together for risk reduction? How to we retain a commitment to consider every resource as "precious" for our coastal communities' future survival?

Kudos goes to a program that is demonstrating some of these important qualities of creating an integrated system of risk reduction and community engagement to which I am referring. It is called the Greater New Orleans Water Plan. It addresses storm-water flooding within the levied communities of Orleans, Jefferson and St. Bernard Parishes. The process of creating the plan, and the current process of refining it and implementing it has brought together a wide variety of non-profit, private sector professionals and government officials across different agencies to "imagine" how the water management dream can come to be. The Water Collaborative efforts stem from a model of engagement honed and implemented by the Horizon Initiative, a volunteer group of residents who have been committed over many years to living with water. The Collaborative contains many young professional water experts and experts-to-be. Reducing risk from storm surge, while not the key focus of these initiatives, is benefitted by the ways the various issues are being shared with different specialists, a cross fertilization that brings more attention to destructive tropical storm risk. Thinking about the pieces of systems is finally beginning to be more comprehensively recognized in these new partnerships and collaborations.

Remember, creating coastal communities that are more resilient, that can better survive the next flood, is not rocket science. But it is more difficult to achieve than building a rocket to Mars. How can we make ourselves, who live in communities in coastal Louisiana do what we must do in order to be able to remain in this place that we so love? Levees are one important piece of the system, but just one, as Bob Turner has noted in advocating for flood insurance behind the levees (NRC, 2012). We haven't nearly adequately figured out yet how to embed them, combine them into the comprehensive, robust system of multiple risk reducing actions that we need and to stay committed to implementing them continually.

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Senator VITTER. Thank you very much, Shirley. Thank you very much. Just a couple of questions. First, let me start with John and Bob, since they're in charge of these systems we're talking about.

Besides future levee lifts, which we've talked about, besides the Corps responsibility to run these big structures, which we talked about—put those on the side—what are the top, besides that, what are the top two or three potential gaps or vulnerabilities in the system that you all are particularly focused on? And each of you can speak in turn.

Mr. MONZON. I think, in general, future funding, to be able to maintain and operate the system, in general. The earthen levees—the flood protection system on the westbank is made up mostly of earthen levees. We have some flood walls. We had some other features that are not in Federal navigable waterways, like the WCC. We have a sector gate and a pump station that we inherited from the HSDRRS projects at the Bayou Segnette complex. That is not part of the—that is not included in the WRRDA bill.

So there are other—just making sure that we have enough funds to adequately operate and maintain, and repair and rehabilitate and replace these features. We cannot go back to the days of Katrina where things weren't done just because we didn't have the funding. So the funding will be critical for the westbank facilities in the future.

Senator VITTER. OK. Bob.

Mr. TURNER. Thank you, Senator. I agree request John with just about everything that he said. I think, you know, there's a couple of things that we really need to be concentrating on here, from my perspective, even on the eastbank, and that is, keeping the system to the authorized level of protection. That is certainly—you know, has to be one of our most important priorities.

And that's going to be difficult to do if we can't get the Corps to participate with, you know, lifting these levees, as they originally, I think, intended to do, as time progresses, because we know that the levees are going to subside, the sea level is rising, and we're seeing the effects of that already.

The other thing I think that we have, you know, we're looking to try to do some changes to, regards the Inner Harbor Navigation Canal Corridor.

And the way that the system is set up right now, whenever there's a storm coming, all the vessels have to be evacuated from that corridor because the—a lot of the areas adjacent to the levees there still have the old I-walls that are still in place, and although they provide protection from normal water levels and high water levels, if they are impacted by a vessel, they're going to fail, and so that could potentially put some water into areas wherever those failures occur. And so, you know, we're still working with the Coast Guard and the Corps to try to do better planning with regards to that and trying to get those vessels out of there.

We have also proposed some ideas on how to further reduce that risk by perhaps using some storage in the central wetlands to—just for a storm event, to further reduce that risk by lowering water levels in the corridor and in the wetlands, as a whole, and so those are the kind of things, I think, that we need to be looking at in the future.

Senator VITTER. OK. Thank you, Bob. And Todd, let me ask you, you and the Chamber work on economic development all the time. I'm curious. As you talk to business folks considering some project here, whether they are from outside the State or whether they're more local, how often are you talking to them about their concerns about hurricane flood protection?

Mr. MURPHY. In almost every occasion. It's certainly a concern, you know, when people are looking to relocate or to expand. They are looking at the entire region from the standpoint of protection from storms, education, transportation, infrastructure, resources, work force. All of those come into play, but certainly, no one wants to expand or relocate only to have to pick up and run.

Senator VITTER. And generally speaking, how often, what percentage of times is that a big factor leading to a decision?

Mr. MURPHY. You know, I would say that it happens on occasion. I think that there's so much that this area has to offer, that it certainly is a lure, if you will, to get companies here and to keep companies here.

I mean, let's face it, people come here and they get hooked, and it typically takes about two Jazz Fests for that to happen.

So, you know, we have a wonderful area and a lot of natural resources that are just abundant. But I think it is a concern. We saw it after Katrina. We saw several of our companies move north, across the lake. They're just simply tired of running. And so it is a concern. I think the confidence level has gotten better. Yet, everyone knows there is still much to be done.

Senator VITTER. Right. OK. We're going to wrap up. In closing—first of all, let's give all of our great witnesses another round of applause. I really appreciate you all being here.

[Applause.]

Senator VITTER. Thank you for your testimony, thanks for all of your work. I also want to thank Messina's, that runs this space, and the Walnut Room. They have put up with us this morning and have been really helpful.

I want to thank AV Express, Todd and his team, Gulf South Media, and Jim Land, our videographer, for helping us today, and I want to thank our hosts, who let us use the building, the Authority that runs the airport and related facilities. Thank you all very much.

And thanks to all of you for coming out. I hope you found this useful, but certainly, I don't want it to be an isolated event. I want it to be a continuing conversation, so please keep this handout that you have handy. On the left-hand side of the page, in the blue column, is all of my contact information.

Please use that as questions, ideas, suggestions or specific problems, like some of the insurance and other problems that we were talking about, come up, call me and my staff, get us involved. We work on that stuff all the time. And if you have those issues today, talk to us here at the table before you leave and we'll get your information and we'll get right to work on it.

And again, this has all of my contact information, including our website, which has easy email access.

As we close and as we go into hurricane season, which starts June 1st, I would just repeat what many of us have said. This pro-

tection system is important. Coastal restoration is important. Mitigation programs, like raising structures, are important, but ultimately, probably what's most important for each of us, as individuals and families, is personal and family preparedness. So take that into account and have a plan, as we approach June 1st.

Thank you all very much for being here today.

[Additional material submitted for the record follows:]

COMPLETE STATEMENT
OF

DR. ARIANA SUTTON-GRIER
(UNIVERSITY OF MARYLAND)

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

SUBCOMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

ON

*Providing Flood Protection for America's Metropolitan Areas—
Responsibility, Recovery, and Rehabilitation*

May 15, 2015

I thank Senator Vitter for the opportunity to submit testimony at this hearing. The topic of flood protection for American metropolitan areas is an absolutely critical one, particularly in light of the projected increasing sea level rise expected in the 21st century. Many communities are already facing nuisance flooding issues where simply a higher high tide leads to coastal flooding. And many more communities will experience severe flooding if a major storm event makes landfall on them. Now is the time to be preparing American coastal communities to make choices about land use and infrastructure investments so that they will be more resilient to flooding and erosion with future extreme weather events.

I recently was the primary author on a paper that was published in the journal *Environmental Science & Policy* entitled, "Future of our coasts: The Potential for Natural and Hybrid Infrastructure to Enhance the Resilience of Our Coastal Communities, Economies and Ecosystems." Here I want to summarize briefly some of the main points of that article and for brevity I have left out the citations, but all of them can be found in the article available online (see the link at the end).

The focus of this synthesis article was to establish the state of our knowledge on the storm and erosion protection provided by healthy coastal ecosystems including: salt marsh, mangroves, coral and oyster reefs, beaches, dunes, and barrier islands (See Figure 1). In addition there are also exciting opportunities for designing shorelines that include a combination of natural and built infrastructure, termed "hybrid infrastructure" which capitalizes on the strengths of both natural and built infrastructure (See Figure 2). In this study we also examined several case studies where hybrid approaches are being implemented to improve coastal resilience as well as some of the policy challenges that can make implementation of these approaches more difficult.

The main findings of our study were:

1. There is substantial evidence that natural infrastructure (i.e., healthy ecosystems) and combinations of natural and built infrastructure ("hybrid" approaches)

enhance coastal resilience by providing important storm and coastal flooding protection, while also providing other benefits.

2. There is growing interest in the U.S., as well as around the world, to use natural infrastructure to help coastal communities become more resilient to extreme events and reduce the risk of coastal flooding.

3. **Natural Ecosystems and Storm Protection:**

Salt Marsh: Coastal salt marsh vegetation plays a critical role in attenuating waves, providing storm protection and stabilizing shorelines by reducing erosion. Vegetation is responsible for 60% of the wave attenuation during storm events, and that even when waves were large enough to break salt marsh vegetation stems, the plants protected the soil from eroding during major storm events. These results suggest that for smaller hurricanes and also for larger storm events, natural or hybrid infrastructure protect shorelines from erosion very effectively and may be more durable.

4. **Mangroves:** Several recent studies in mangroves have determined that vegetation structure and species composition are key for storm protection benefits. Mangroves have been shown to be especially good at providing protection from tsunami damage largely due to their complex aerial root structure, which proved to reduce wave damage while trapping manmade debris, lessening impacts to communities behind forests. The ecological factors that generally affect the amount of wave reduction that can be expected from coastal wetlands and mangroves include: the size of the ecosystem, the vegetation density and stiffness (which contribute to an understanding of surface roughness or the frictional resistance), and plant biomass production. The larger the area of continuous ecosystem, the more coastal protection it can provide. However, even narrow bands of coastal wetlands can significantly reduce wave heights, as can coral reefs.
5. **Reefs:** Coral and oyster reefs also provide important storm protection benefits. Coral reefs reduce wave height by 84% and wave energy by 97% on average.
6. Strengths of natural infrastructure are that it can be self-maintaining, has the

potential to self-repair after major damaging events, and, in many cases, has the ability to grow and keep pace with sea level rise.

7. **Value of Storm Protection Benefits:** Resilience and protective benefits provided by coastal ecosystems against waves, floods and storm surge is very valuable.
 - a. Coastal wetlands in the U.S. were estimated to provide \$23.2 billion per year in storm protection services alone based on a regression model of 34 major hurricanes to hit the U.S. since 1980; a loss of 1 hectare of wetland in the model corresponded with increased average storm damages of \$33,000 from specific storms (Costanza et al., 2008).
 - b. Another estimate for southeast Louisiana determined that coastal wetlands demonstrably reduced storm surge and that a 0.1 increase in the ratio of wetland to open water resulted in saving three to five properties—avoiding damages estimated between \$590,000 and \$792,000—for a given storm (Barbier et al., 2013).
 - c. However, there are relatively few studies that have quantified the value of natural ecosystems for storm and erosion protection and to our knowledge, no one has assessed the value of hybrid approaches to date in the peer-reviewed literature.
8. The benefits of natural and hybrid approaches are not limited to the value of coastal protection they provide but include many co-benefits that are key to strengthening the three pillars of resilience.
 - a. Example: The Nature Conservancy installed oyster reefs in the Gulf of Mexico, they found that, in addition to significant reductions in height and energy among the highest 10% of waves, 5.6 kilometers of oyster reef translated to more than 6,900 pounds of additional catch per year (39% commercial and 61% recreational) and removal of up to 1,888 kilograms of nitrogen per year from surrounding nearshore waters (The Nature Conservancy et al., 2013b).
9. Built infrastructure and natural infrastructure have different strengths and

weaknesses (Table 1). Built infrastructure is well understood and has been used in coastal protection for decades. There are many advantages to built infrastructure in protecting communities, but its effectiveness declines over time and it does not have the capacity to adapt to changing coastal conditions. Built infrastructure is strong immediately upon its completion, but it has a set lifetime, weakens with age, and is constructed to specific parameters that cannot adapt to changing sea levels or other conditions.

10. **Hybrid Infrastructure:** A new approach termed hybrid infrastructure combines natural and built approaches. For example, there is also the potential to use natural infrastructure to protect built infrastructure, lessening the impacts of storm energy on built infrastructure (in the U.K. they call this “managed realignment.”). There is also the potential to use temporary built infrastructure to protect natural infrastructure, such as a restored marsh, as it establishes. Communities, such as Howard Beach, NJ, are considering combining marsh restoration with options such as removable flood walls or moveable flood gates that are only used when a storm is approaching. “Living shorelines,” are another hybrid approach which uses a combination of habitat creation or restoration and built infrastructure to provide protection from erosion and storms while also providing some of the benefits of natural habitats.
11. Many examples of where hybrid approaches are being considered or implemented exist including as part of the “Rebuild by Design” effort in New York and New Jersey, the PlaNYC efforts that New York City is leading, and the “Designing with Water” efforts Boston, MA is doing. International examples also exist, for example, the Dutch have had a “Living with water” effort for many years and in Seoul, South Korea, the city redesigned a freeway to be able to handle monsoon flooding during the wet season and to provide important recreational opportunities during the dry season.
12. **Some Challenges of Natural and Hybrid Approaches:**
 - a. One challenge of using natural infrastructure for coastal protection is that ecological parameters are not the only factors affecting the amount of

storm protection it can provide. The type of storm can also affect the wave reduction potential of natural ecosystems. Natural ecosystems tend to reduce wave energy better for faster moving storms. During slow-moving storms with prolonged winds, storm surge has a chance to accumulate for longer periods of time, pushing water through the vegetation to the ecosystems or human communities located behind them. Thus for slower moving storms, vegetation provides some wave reduction but is less effective in reducing storm surge.

- b. Another challenge is that we need a better understanding how natural infrastructure approaches perform during extreme events is key to assessing overall coastal resilience and also of the social implications of different options. Also, there are a lack of data for informing cost benefit analysis (CBA) studies where built infrastructure options are compared to natural or hybrid options. Because there are usually data available for built options on the cost of construction and the anticipated benefits, but similar data for natural or hybrid options are often lacking, comparisons of the two options are difficult. Thus, there are a number of research needs that will hopefully be filled as more natural and hybrid projects are implemented. These data will help support coastal planning.
- c. Another current challenge with implementing living shorelines hybrid approaches is that permitting for these projects can take much longer than a permit for built infrastructure such as a bulk head because living shorelines projects often have to apply for an individual Clean Water Act 404 permit, while bulkheads can often be covered under an Army Corps Nation Wide Permit which are generally granted more quickly.
- d. Additional challenges include a lack of data for informing cost benefit analysis (CBA) studies where built infrastructure options are compared to natural or hybrid options. Because there are usually data available for built options on the cost of construction and the anticipated benefits, but similar data for natural or hybrid options are often lacking, comparisons of

the two options are difficult.

13. **Conclusion:** There is no one size fits all solution for improving coastal resilience, many strategies are needed to improve coastal resilience, including developing improved natural and hybrid coastal protection systems. Thus, to protect coastal communities from major storms and flooding, investment in coastal ecosystem restoration or protection of existing, healthy ecosystems where they remain, is one of the best strategies for increasing coastal community resilience. And it has the added benefits of ensuring that healthy coastal ecosystems also provide the many additional benefits to support coastal livelihoods, economies, and societies. It is also worth noting that, under the auspices of the National Science and Technology Council, federal agencies are collaborating through the Coastal Green Infrastructure and Ecosystem Services Task Force to identify a limited number of research needs that are germane to filling key knowledge gaps around the use of natural and hybrid approaches. The Research Agenda, *Ecosystem Service Assessment: Research Needs for Coastal Green Infrastructure*, will be released this summer, and is intended to focus current and future efforts and resources across federal agencies to fill these knowledge gaps and thereby advance implementation of these approaches. Despite the challenges and research needs, it is clear that natural and hybrid infrastructure approaches have a lot of potential to help increase the resilience of coastal communities. Now, before the next big storm, is the time to develop regional and national strategies for coastal risk reduction that include a greater focus on natural and innovative hybrid infrastructure, in combination with appropriate built infrastructure where necessary.

All citations and additional information can be found in the article which is available online via open access at the following link:

<http://www.sciencedirect.com/science/article/pii/S1462901115000799>Sutton-Grier, A.E., K. Wowk, and H. Bamford. 2015. Environmental Science & Policy. 51: 137-148. doi:10.1016/j.envsci.2015.04.006

Fig. 1. Examples of natural (top row) and built (bottom row) infrastructure. Photo Credits: NOAA for all images except Dunes (credit: American Green), Sea Wall (credit: University of Hawaii Sea Grant), and Levee (credit: J. Lehto, NOAA).

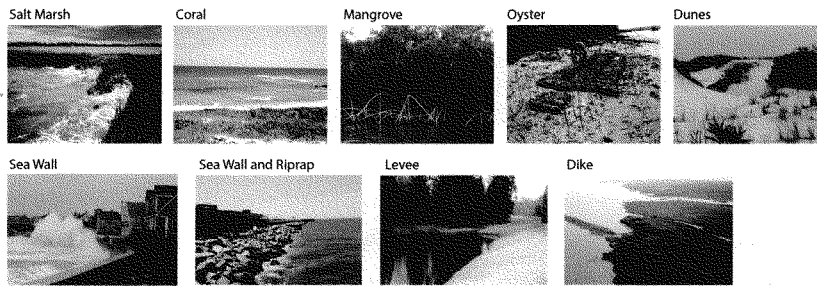
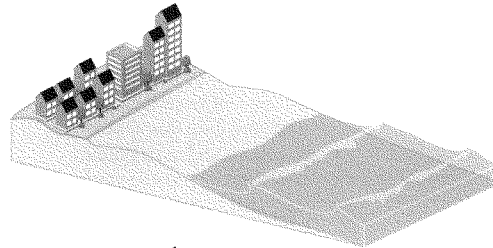


Fig. 2. Examples of coastal defenses including natural infrastructure, managed realignment, and hybrid approaches.

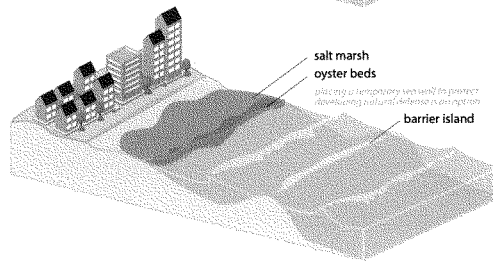
Minimal Defense

Many communities have developed right along the ocean with only minimal natural defenses from a small strip of beach between them and the ocean.



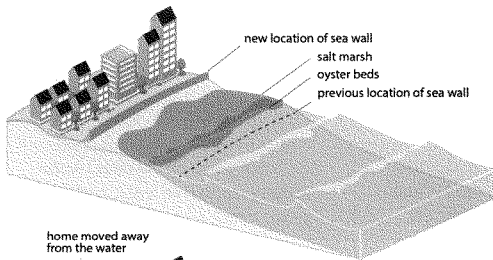
Natural

Natural habitats that can provide storm and coastal flooding protection include salt marsh, oyster and coral reefs, mangroves, seagrasses, dunes, and barrier islands. A combination of natural habitats can be used to provide more protection, as seen in this figure. Communities could restore or create a barrier island, followed by oyster reefs and salt marsh. Temporary infrastructure (such as a removable sea wall) can protect natural infrastructure as it gets established.



Managed Realignment

Natural infrastructure can be used to protect built infrastructure in order to help the built infrastructure have a longer lifetime and to provide more storm protection benefits. In managed realignment, communities are moving sea walls farther away from the ocean edge, closer to the community and allowing natural infrastructure to recruit between the ocean edge and the sea wall.



Hybrid

In the hybrid approach, specific built infrastructure, such as removable sea walls or openable flood gates (as shown here) are installed simultaneously with restored or created natural infrastructure, such as salt marsh and oyster reefs. Other options include moving houses away from the water and/or raising them on stilts. The natural infrastructure provides key storm protection benefits for small to medium storms and then when a large storm is expected, the built infrastructure is used for additional protection.

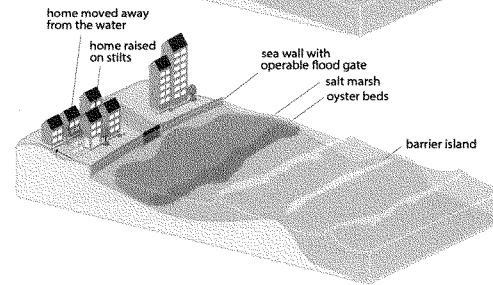


Table 1: Summary of Infrastructure Strengths and Weaknesses by Type

Infrastructure Type	Strengths	Weaknesses
Built (seawalls, levees, bulkheads, etc.)	<ul style="list-style-type: none"> • Significant expertise already exist on how to design and build such approaches • Decades of experience with implementing this approach • Excellent understanding of how these approaches function and what level of protection will be provided by different types of structures built to specific engineering standards • Ready to withstand a storm event as soon as they are constructed 	<ul style="list-style-type: none"> • Does not adapt with changing conditions such as sea-level rise • Weakens with time and has a built-in lifetime • Can cause coastal habitat loss and have negative impacts on the ecosystem services provided by nearby coastal ecosystems • Can lull communities into thinking they are safe from all disasters leading to increased loss of life or property • May sustain more damage during small storm events than natural approaches • Only provides storm protection benefits when a storm is approaching; no co-benefits accrue in good weather
Natural (salt marsh, mangrove, beach, dune, oyster and coral reefs, etc.)	<ul style="list-style-type: none"> • Provides many co-benefits in addition to coastal protection including fishery habitat, water quality improvements, carbon sequestration and storage, and recreational use, and can provide these benefits to coastal communities all the time, not just during storm events • In the case of ecosystem restoration, the ecosystem grows stronger with time as it gets established • Has the potential to self-recover after a storm or forcing event • Can keep pace with sea-level rise 	<ul style="list-style-type: none"> • Need to develop best practices for how to restore ecosystems • Provides variable levels of coastal protection (non-linearity of the provisioning of coastal protection benefits) depending on the ecosystem, geography and also on the type and severity of storm; need more research to better understand how to estimate or predict the coastal protection provided • In the case of restored ecosystems, it can take a long time for ecosystems to

	<ul style="list-style-type: none"> • Can be cheaper to construct • Can survive smaller storms with less damage than built infrastructure, and can self-repair 	<p>get established for the natural systems to provide the necessary level of coastal protection</p> <ul style="list-style-type: none"> • Likely requires a substantial amount of space to implement natural approaches (such as ecosystem restoration or protection of existing ecosystems) which may not be possible • Few data on the cost to benefit ratio for projects • Permitting for natural projects can be a more difficult process than for built projects • Growing but still limited expertise in the coastal planning and development community on which approaches to use where and when
<p>Hybrid (combination of built and natural)</p>	<ul style="list-style-type: none"> • Capitalizes on best characteristics of built and natural • Allows for innovation in designing coastal protection systems • Provides some co-benefits besides coastal protection • Can provide a greater level of confidence than natural approaches alone • Can be used in areas where there is little space to implement natural approaches alone 	<ul style="list-style-type: none"> • Little data on how well these systems perform to date • Does not provide all the same benefits that natural systems provide • Need more research to design the best hybrid systems • Growing but still limited expertise in the coastal planning and development community on which approaches to use where and when • Hybrid systems, due to the built part of them, can still have some negative impacts on species

		diversity <ul style="list-style-type: none">• Few data on the cost to benefit ratio for projects• Permitting for hybrid projects can be a more difficult process than for built projects
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