Karla: Good afternoon. Thank you for joining us for the North Atlantic Coast Comprehensive Study Report Release Webinar. My name is Karla Roberts and I will be your facilitator for today's Webinar. Today, you will hear from several members of the study team on various aspects of the North Atlantic Coast Comprehensive Study often referred to as NACCS. Following the presentations, we will have a brief question and answer period. All slides and audio from today's Webinar will be made available on the NACCS Web page within a few days. Before we jump into today's presentation, I'd first like to introduce Tegan Hendrickson who is our AT&T technical moderator. She will provide some technical guidance for today's call, and also explain how to ask questions. Tegan?

Tegan: Thank you, Karla. First, please note at this time that all audience member lines are muted and in a listen only mode to minimize background noise. Second, you are welcome to submit questions during the presentation, and these will be addressed during the planned Q&A session. Please use the send note button in the top toolbar or the notes tab on the right hand side of your screen, and address your notes to all moderators.

During Q&A, there will also be the opportunity to answer your questions verbally, and we will give you instructions at that time. If you experience any technical difficulties, please send a note to Moderator USA or contact AT&T Connect support at 1-888-796-6118. Now, I'd like to turn the conference back over to Karla. Please go ahead.

Karla: Thank you, Tegan. We will now move into the presentation portion of today's Webinar. Slide two presents the outline for today's presentation. Our first presenter is Ms. Amy Guise. She's with the command center for the NACCS, and she's of the State Baltimore District Planning Division. Amy will provide an overview of the NACCS including some of the findings, outcomes, and opportunities, a description of the coastal storm risk management framework, and risk management measures. Amy?

Amy: Thank you. First, I'd like to thank everyone who has collaborated and worked with the Corps on this study over the past two years. We've integrated data and expertise from a diverse set of coastal experts and agencies, and I think you'll see much of that reflected in the description of our products today.

Public law 113-2, the Hurricane Sandy Emergency Supplemental provided billions of dollars in the aftermath of the storm. One part of that, specifically, up to $20 million was provided to the Corps of Engineers to conduct a comprehensive study to address flood risk of vulnerable coastal populations within areas affected by Hurricane Sandy.

We were further directed to complete the study in two years with submission to congress by January 2015, and this was completed actually last Wednesday. This inset depicts the study area over 31,200 miles of coastlines. Everything in green, yellow, red, or purple was designated by FEMA as having a very high, high, moderate, or low impact, and were included in the analysis.

That said, one of our objectives was to develop transferable products and analysis so that any coastal community could benefit from the expenditure of these funds. Goals of the study were to provide a risk reduction framework and support resilient coastal communities. The goals were meant to arm all of us with the ability to evaluate and know our risk, and then do something about it. We all want a more resilient future state of the coastline.

The goals lead us to this end state, a comprehensive plan that serves as a common platform for understanding current and future risk and understanding what management measures and strategies are appropriate for each reach of coastline. Another end state is that we will have a consistent approach that can be repeated and used by communities whether they are advanced or not in their coastal risk management planning.

We aimed to integrate advancements and tools and the state of the science supporting risk management. Beyond developing the framework, we developed or partnered with others to highlight tools that can be used to support or complete each step of the framework. Finally, it's about being able to make informed decisions in a cost-effective manner.

We employed extensive use of GIS and demonstrated how this can be used efficiently to inform and make decisions. It's also important to note what the study is not. Unlike traditional studies, the NACCS is not a decision document authorizing design and construction, and it is not a [NEFA 00:04:47] document evaluating impacts of any specific solutions.

It is not a USACE only application, and it was informed through the help of many stakeholders and partners. From the outset, we were challenged by a 10 state plus the District of Columbia study area with a two-year deadline. We really had a one year production and analysis mode. We were diverse in our collaboration from formal letters to embedding inter-agency experts in our team to developing a website and inter-agency webinar series.

The webinar series took key technical topics from NACCS, described how we planned to approach the topic, demonstrated those analysis, and requested feedback or additional information we might not know or have. The next three slides represent the findings, outcomes, and opportunities of the NACCS.

Key findings include a shared responsibility for risk management, adapting to risk and considering combinations of solutions across agencies as key to being ready for the next big storm. Low-lying areas within our region are particularly susceptible to even small changes in water level whether from surge, climate change or increases in development patterns. The illustration depicts a full array of coastal storm risk management measures which can be integrated in varying combinations through uses of the framework.

Our outcomes were driven by wanting to put products in the hands of others, so that under this umbrella of shared responsibility, we all have the tools and information needed to move forward. Along these lines, each state and the District of Columbia have their own appendix of state analysis and data. They will also receive a geo database of data that we collected so that they can replicate our process. We also closed many data gaps through collaboration with others, and I will touch on this in more details later.

Coastal communities face tough choices as they prepare for changing conditions including potentially devastating coastal storms. To help them, the comprehensive study identifies regional and national opportunities to increase coastal resilience and reduce vulnerability for these high risk areas. [As to 00:07:13] improvements to our current planning and development patterns that account for future conditions, the next devastating storm event could result in similar or worse impacts than Hurricane Sandy. No matter what risk reduction strategies are taken, there will always be residual risk.

Clear communication of residual risk is critical to coastal resilience and sustainability. As for our opportunities, they range from prioritizing critical infrastructure to creating incentive programs and public-private partnerships to identify nine focused areas warranting further analysis.

The legislation directing this study also asked us to identify areas warranting additional analysis. Along these lines, nine areas seen on this map were identified as not having on-going Corps of Engineers projects, and potentially warranting additional involvement or action. The nine areas are, from north to south, the Connecticut coastline, the Rhode Island coastline, New York-New Jersey Harbor, its tributaries in Jamaica Bay, Nassau County back bays, New Jersey back bays, Delaware back bays, the city of Baltimore, Washington, D.C., and the city of Norfolk, Virginia.

The framework set out to answer the following questions for the region which I must add were expressed as needs by the state, non-governmental organizations, and others in the coastal community when we started. We really wanted to assess and identify where it gets wet, who and what is within those areas, and are vulnerable to getting wet, what can all parties responsible for

managing flood risks do about those areas, people, and things that get wet, and what more do we need to know.

Managing coastal storm risk is a shared responsibility by all levels of government and individual property owners. It is critical that we work as an integrated team to form a comprehensive strategy. Here is our nine-step coastal storm risk management framework. As we all know, managing coastal flood risk is complex.

There are economic, social, and environmental factors to consider, layers of government involved, and dozens of ways to reduce risk from using man-made features like levies and seawalls to using natural features like salt marshes and maritime forests. Because every location is different, there is no recipe for a best solution.

Most important, a common methodology that the public and private interests can follow together to assess risk and identified solutions is presented here. This methodology, as provided in the study, is the coastal storm risk management framework. This framework is customizable for any coastal watershed. This framework is informed by several planning tools and models that are included in the report.

The study area was divided into 39 reaches. These reaches also allow the regions to be broken down into more manageable pieces. It also enables follow-on analysis and implementations by any entity to be conducted in a systems context. Each reach is a system. Reach designations were based on existing natural and man-made coastal features such as shoreline type where a Corps of Engineers and other flood risk management projects already exist, the 1% annual chance, or 100-year flood plain, and aerial photography.

As part of the framework, the extent of coastal flood hazard or the extent of inundation was completed using available mapping. This mapping represents varying levels of probability and corresponds with other agencies' regulatory and planning efforts. The next three maps are illustrations for this presentation but were completed for each of the 39 reaches.

The mapping here represents inundation zones identified from the SLOSH model, the most advanced storm surge model covering the entire study area and depicts areas of possible flooding based on the maximum of maximum events, or the most extreme scenarios. This mapping presents the 1% flood plus three feet sea level rise allowance for the New York-New Jersey-1 reach. Areas between the category four, maximum of maximum mapping in the previous slide, and the 1% flood plus three feet here are an example of residual risk.

The third illustration represents the limit of the 10% flood plain ... And/or greater chance of being flooded in any given year. The purpose of the 10% flood plain is to be able to consider flood risk management performance of various natural and nature-based features with respect to storm surge. This enables communities to evaluate the risks or opportunities associated with natural and nature-based features at a site specific scale.

After depicting the current conditions, we also had a concerted effort to forecast future conditions. Future sea level rise projections were developed for the Corps' low, intermediate, and high scenarios, and the NOAA high projection for 30 NOAA gauged locations in the study area. Further, the sea level change considerations are presented over four time horizons.

2018 was considered the current condition selected to represent the date by which most of the post-Sandy construction would be complete. 2068, a 50-year time horizon from the current conditions of 2018. 2100 from the intergovernmental panel on climate change, and an accepted future reference from scientific literature, and 2118, the 100-year time horizon from the current condition of 2018.

Sea level change mapping for each reach is included in each state appendix, so it can be used in adaptation planning. This particular graph shows the Sandy Hook gauge New York, change in these sea levels over time for each of the scenarios. The landscape in our conditions are constantly changing.

Unfortunately, many past decisions have resulted in actions that are not readily adaptable to change. Their framework allows a flexible approach that can be adapted to changing conditions, policies, or societal needs, and values over time. It was key to identify these future trends, so decisions made now can be made with an eye to the future. What do we know about the future? Sea level is increasing. Populations are increasing. Urban development is increasing. Populations are aging. Habitats are subject to more and more stress, to name a few.

This is the backbone of our report title, Resilient Adaptation to Increasing Risk. We know for a fact that risk is increasing. As I previously described, the flood hazard was defined using flood inundation mapping. This is where it gets wet. Who and what gets wet is the exposure. For each reach, we use GIS and map for exposures, population and density, socioeconomic groups, environmental and cultural resources and sensitivities, and then combined these three into one composite view of exposure.

Looking at the map even at this regional scale, you can see the obvious high exposure in the New York area. When you zoom into each reach, this is what you

see, areas of high to low exposure based on the various criteria. Here, some of the population and infrastructure, data sets and criteria included. Department of Homeland Security data, population density and critical infrastructure supporting these populations such as sewer, water, electrical, trash, medical, and safety considerations.

Socioeconomic exposure used 2010 census block data for the following, the percent of the population over age 65 or under age five. Population with income below poverty, percent of population not proficient in the English language. These groups, for example, may be at higher risk for not understanding or not being able to evacuate or heed warnings prior to a storm events.

Environmental and cultural exposure came from national data sets such as the National Wetland Inventory, Nature Conservancy Ecoregions, and U.S. Fish and Wildlife Service rare, threatened, and endangered species data. In addition, data on historic sites and national monuments were incorporated into this evaluations.

Finally, a composite exposure was depicted by a summation of the three individual analysis to convey overall exposure. This was developed in a way that more local data sets can quickly be added to the GIS analysis and communities and decision makers can assess, more specifically, who and what may be at risk which may inform future proactive planning.

The framework then takes the probability of flooding, the frequency, and multiplies it by the exposure to generate a risk assessment. This, essentially, better defines the risk in any given area. This is a course level risk assessment with data available from across the 10 state region. We call this regional assessment our tier one analysis. 100-year flood insurance rate maps indicate higher risk the closer you are to the flood hazard, and this risk assessment attempted to visualize that.

Understanding sea level change and what can be further exposed to flooding in the future is critical. Using the EPA integrated climate and land use scenario data, we projected future populations and development across the landscape from 2010 to 2070 using GIS. This was then compared to sea level change mapping and potential future impacts are documented for each reach.

The B2 storyline selected for this analysis is a broad level, moderate scenario used by the intergovernmental panel on climate change. This assumes a moderate increase in population, economic development, fertility, mortality, and migration. Now that we know where it gets wet, and who and what gets wet, now and into the future, the framework takes you to an evaluation of risk management measures.

The document, a full array of measures in this study includes structural and natural and nature-based features, non-structural measures, policy and programmatic elements, and blended solutions which are particularly key for resilience and adaptation planning over time. We canvassed existing reports, held working meetings with industry and academia, and developed a diverse set of management measures.

Knowing not all measures are equally applicable everywhere, we assessed the appropriateness at a regional scale of each measure against the NOAA shoreline type classification. This is called our tier one analysis, which was completed for the entire study area and was meant to help communities and practitioners refine their options to be evaluated in more detail during a tier two or tier three analysis. The next level of detailed analysis can use the very same methodology and framework.

Of particular interest was the inclusion of natural and nature-based features. As part of the study, NNBF, natural and nature-based features performance was evaluated at several sites. Tools were developed to help assess and evaluate the range of benefits that can come from including these features in the landscape such as ecosystem services, improved recreation, quality of life, habitat benefits, and more. The report advanced the science on NNBF, and a full report discussing the benefits and performance functions is available on our website.

To demonstrate how measures including NNBF can be integrated and evaluated as blended solutions, we offer this example. Across the top are the individual measures. Maybe B1 is a bulkhead, or NB1 is a natural-based feature such as a marsh, and so on. Then vertically we have S1 through S6, the range of services or benefits from each feature.

As you can see, employing more than one feature in a blended solution, maybe even all, can provide a wider range of benefits for risk reduction, resilience, adaptation planning, or other societal needs. NNBF cannot be oversold, however. While the study area has many back bay and estuarine areas where this may be a very appropriate solution, it may not be ideal in other locations and conditions.

We conducted yet another GIS analysis looking at the entire region. This analysis enabled us to show where conditions beyond ridge reduction exist to support NNBF. We primarily looked at habitat type, water quality parameters, topography, and dosimetry. NNBF may have the ability to assist in ridge reduction, but that is only if they can successfully exist in their primary habitat conditions.

Parametric costs were then developed for structural and non-structural tier one measures. These were based on generic designs, observations of costs of existing projects, and typical quantities. This was to provide the user with an understanding of the financial planning and financial partnership that may be needed to implement certain features and systems. These are not site specific costs.

Each state appendix includes a sample area where we applied a more detailed tier two analysis. With state consultation, each state and the District of Columbia selected their tier two sample area. Here, we refined costs using updated lengths, and based them on the 100-year plus three-foot design level.

For all the measures for that area, we divided the cost by the most expensive measures to derive a cost index for the tier two example area. This created a relative cost ranking of the measures. Again, this is to inform and educate others on the relative costs associated with individual measures or combinations of solutions.

Karla: Thank you, Amy. Our next presenter will be Mr. Jason Engle who is the lead engineer for the climate change adaption planning and sea level change analysis, completed as a part of the NACCS. Jason will now provide an overview of the climate and sea level change aspects of the study including climate change adaptation planning. Jason?

Jason: Good afternoon, everyone. Thank you for calling in today. An overview of my talk, first I'm going to discuss the U.S. Army Corps of Engineers and NOAA sea level change scenarios. Going to discuss those scenarios in the context of state and local sea level change scenarios, discuss the GIS mapping that was performed, look at the statistical analysis of extreme water levels, and discuss the flood risk and sea level change mapping final products, and finally, climate change adaptation change and planning concepts. Next slide.

As mentioned by Amy, we use four sea level change scenarios in the North Atlantic Coast comprehensive study. The three scenarios with the Army Corps of Engineers published in 2014 in ER 1100-2-8162 are shown here on the upper right in green, yellow, and orange. In addition, we included a NOAA scenario published in 2012 using the NOAA high. It's slightly higher than the Army Corps of Engineers high spanning the full range of federal sea level change scenarios.

These were computed for 26 locations between Virginia and Maine. These are NOAA long-term water level stations with records longer than 40 years. In the lower left, you can see the station names starting with Virginia on the left, and up through Maine on the right hand side. This happens to be a plot of the U.S.

Army Corps of Engineers high scenario for three different time frames, the year 2018, 2068, and the year 2100. Next slide.

Those same scenarios are shown here in the left and right panel. This happen to be for New York City. The scenarios in the left hand side, the dots represent New York City and PCC scenarios for low, middle, and high. Those dots are green, yellow, orange, and red. You can see that those conform rather well to the Army Corps of Engineers scenarios and NOAA scenarios. On the right hand side, you can see the state of New York DEC scenarios that are employed by the state in green and red. Next slide.

Pardon me. I should say that we did a comparison of all of the state scenarios and those can be found in the state appendices to the comp study. Here's a depiction of some of the GIS mapping products. On the left panel are areas that will be below mean sea level for the Army Corps of Engineer's high scenario at 50 years and the year 2100. At 50 years is light blue. At the year 2100 is dark blue.

On the right hand side is that same map with the EPA Integrated Climate and Land Use scenarios overlaid. This indicate areas where development density is expected to increase, and you'll notice that those overlap in many cases with the areas that are vulnerable to sea level change. Now, this is just an example. This was done for all 39 reaches and those again are in the state appendices.

Next, we conducted an analysis of extreme water levels using the NOAA water level gauges I mentioned previously. This analysis was done for 23 of those 26 locations, water level stations that had a long enough continuous record. Here on the left, you can see the return period for water levels for Sandy Hook, New Jersey, and the arrow points to the approximate extreme water levels for that location for Hurricane Sandy. That's estimated to be approximately a 400-year recurrent interval event for Sandy Hook.

Now when you add the Army Corps of Engineer's high relative sea level rise in 100 years, it's approximately a meter and a half. You can see that the effective sea level change would increase the frequency of this type of water level event. This analysis of return frequencies of extreme water levels were also used to calibrate the numerical modeling that Lynn Bocamazo will talk about.

Next slide. Finally, we merged all of these products into this flood risk with sea level change. What you see in tan is the 1% annual exceedance probability flood. This is the type of storm that would have a 1% chance in any given year of occurring and the inundation is shown in tan.

Similarly, the brown represents a 1% annual exceedance event, plus three feet. This is closely aligned with the Army Corps of Engineer's high scenario for 2068

and with the New York City recommendations of plus three feet. The 1% inundation was obtained from FEMA firm maps. The 1% plus three feet was obtained from FEMA/Category two maximum of maximum flood plain. Again, the 10% annual exceedance water levels mapping, those were obtained from the extreme water level analysis that I just detailed. Next slide.

Karla: Thank you, Jason. I will now hand it back to Amy Guise to provide an overview of the view of the technical products produced as part of the NACCS. These are parallel effort element of the framework and contained a lot of useful information. All products are available on the NACCS website. Amy?

Amy: Thanks, Karla. Thank you, Jason. As I've noted, the NACCS provide advancement in the state of the science and data to eight communities in completing the framework steps. On the left, you will see the first five steps and the nine-step process. On the right are the associated products, tools and models developed in this study and available on our website to help coastal communities in gathering data and making decisions.

Some of these tools were created or updated by the Corps of Engineers but many also come from our federal and state partners. I will share a few slides highlighting some of the products. On the economic side, we developed coastal depth damage curves for the region. Existing curves are primarily focused on fluvial events. This closed a prominent data gap.

We also looked more deeply at emergency costs and secondary and tertiary effects. For example, if a road was closed, there's an immediate cost associated with that. However, if that then prohibited 300 people from getting to work in school for one week, either secondary and tertiary effects and costs that are frequently not captured but that are very real.

The product of this work developed new curves for the entire region and a report documenting the relationships of secondary and tertiary impacts will be available. To support the system's context, we completed a regional sediment budget for the study area identifying the sources and things for the sediment.

This will assist others by highlighting where sediment maybe nearby and could be applied at the beneficial use or identifying where you might not want to place a certain feature because it is a regional sediment [sink 00:31:22]. There is great value simply learning what is currently available. Here, we highlight two products like that. On the left of the screenshot of the coastal program guide, this will inform state and communities about the range of programs and assistance available across agencies and will guide them and follow on planning, mitigation and adaptation.

On the right is the U.S. Fish and Wildlife Service planning aid report that characterizes the entire East Coast from a habitat and species perspective. This base line conditions and future projections now serves the spring board for all ongoing and future coastal studies.

Karla: Thank you, Amy. Our next presenter will be Ms. Lynn Bocamazo. Ms. Bocamazo is the chief of the Hurricane Sandy Relief Branch and Engineering Division for the U.S. Army Engineer District, New York. She will provide an overview of the numerical modeling efforts conducted as a part of the study. Lynn?

Lynn: Thank you, Karla. I have a few slides on the numerical modeling study. The numerical modeling study was developed to create a storm suite for the North Atlantic Coast of the United States. We, in North Atlantic Coast, to provide a comprehensive evaluation of storm impacts and storm parameters developed this model with a goal of quantifying the coastal storm hazard throughout the region.

Then, to provide the environmental forcing database for use in future project design and evaluation as well as to be used for wide range of other planning studies as well as vulnerability assessments. Resiliency studies and critical infrastructure evaluations. The products of the study do include wave, wind, water level, meteorological data, storm characteristics such as hurricane track, radius of maximum winds and we also ought providing the specifics of peek responses of the areas performance. Next slide.

The C Storm modeling system was used to provide this high fidelity, well-bedded modeling. It combines the whim, off shore wave model, the ST wave coaster inset modeling for wave impacts and also, assert the circulation models which takes into account [wherein 00:34:05] water flows, ocean boundaries and the environmental forcings of the wind conditions during storms. Next slide.

The C Storm modeling system was created with 10,050 synthetic tropical storms as for examination of the storm history within the area from Maine through Virginia. 100 historical extra tropical storms, [forced 00:34:42] combination of 1150 simulation storm suite. Three conditions were modeled, a base condition. A base condition with tide in river inflow. Then, the third condition is the base condition with tide, river inflow and sea level change combination.

A total of 3450 storm simulations were done throughout the modeling domain. There are approximately 19,000 saved points throughout the modeling domains. Those saved points were coordinated through our North Atlantic Division districts reaching out to local authorities and local stakeholders to develop the location where the information would be saved out of the modeling system.

The information will be available on the coastal hazard system. We are working through some technical difficulties and security concerns for that. However, [inaudible 00:35:59] that information is available at this time. Next slide please. Again, we used historical storms primarily to develop the flow array of storms to be modeled and especially in the most northern regions of the area for the extra tropical storms. We also created synthetic storms to develop the various storm parameters to understand a full, but we call a probability space overtime and over the geographic regions from Maine through Virginia.

We use the state of the art specifical methodology of JTMOS which has been updated since Hurricane Katrina. We've taken lessons learned from work that was done since Hurricane Katrina to develop this modeling system. I would like to mention that the modeling system, the work was performed by the Coastal and Hydraulics Lab in Vicksburg, Mississippi. Next slide please.

The benefits of this work was to develop a consistent database throughout the region to provide information for coastal engineering and management communities for approximately the next ten years is we had economies of scale because of the spacial expense and the quantity of reusable data from this regional models. As I mentioned, we made technical advances to the coastal storm modeling system since the time of Hurricane Katrina.

We used enterprise modeling and analysis methods and information from this work will be now used in Corps of Engineers' Engineering Guidance Update. I think that's my last slide. I'd like to give it back to Karla. Thank you.

Karla: Thank you, Lynn. Just a quick reminder before we move forward. All of these slides and audio from today's webinar will be made available on the NACCS' website probably within a few business days. Our next presenter is Dr. Kelly Burks-Copes. Dr. Burks-Copes is a research ecologist with the U.S. Army Engineer Resource and Development Centers Environmental Laboratory. She is part of a Multi-Disciplinary Team tasked with the characterization, evaluation and integration of natural and nature-based features into the multiple lines of defense recovery strategy. Kelly?

Kelly: Thank you, Karla. Today, I want to talk to you about one of the technical products that we just recently put out there on the internet for you all. It's the Natural and Nature-Based Features report. I'd like to walk through the various chapters and information that's provided there and give you kinds of synopsis of what you can find there. It's 480 pages. It is available on the NACCS' website and I have gone on the first five there launched to that or you can get it at the Engineering with Nature's website as well.

The report itself is focused around four major things, the characterization of natural and nature-based features and how they can contribute to Coastal [inaudible 00:39:32]. How one might go about gathering data and metrics that can be used to assess the performance of these features, inclusions or stand the line. Examples of how one might go about evaluating the proficiency of implementing natural and nature-based features.

We've got a few case studies to show what one might do to use NNBF in recovery site for example. Then again, we have some discussion of policy implications. This is a frontier and the idea of contributing to the overall resilience of it at a system-wide level is new science and so, what we've done is highlighted some policy implications and things they might trip on and that we need to work further on and some ideas about future research.

In the next several years, that might help us from this concept of natural and nature-based features further. Just to begin before we change the slides, let me very clearly define what we mean by natural features, nature-based features and then, the built components with [windows 00:40:36] solution.

With the idea that what we're trying to talk about here is multiple lines of the sense. We have the need for because we've been in [slow 00:40:46] protection against this big storms but during the rest of the year, natural features or nature-based features can contribute to the overall societal health and well-being. What we want to do is start taking credit or accounting of that in our long term strategization.

For natural features, look at those that are created or evolved overtime through the actions, the physical, biological, geologic and chemical processes that offered in nature. Natural features take the variety of forms. They could be reef, coral or [inaudible 00:41:21], barrier island, dunes, beaches, wetlands and even maritime forest. The relationships and interactions among the natural and nature-based features comprised the coastal system and there are important variables that we need to assess to determine coastal vulnerability, the reliability, the risk and the resilience of the systems that we're proposing to recover in design.

Nature-based features, on the other hand are those that mimic because they stick with the natural features but they're created by human. We designed them and we engineered them and we construct them to provide specific services such as coastal risk reduction.

The built components of the system are not going to go away. We need to actually address blended solution, combinations at natural features, nature-based features and built. Various systems, the built component include the nature-based and other searches that supports the range of objectives including

erosion control, storm risk production as well as infrastructure providing economic and social functions like navigation councilor, [harbors 00:42:26] and residence housing.

On the next slide if you will, I want to say first of that I did not do this on my own. There is a massive team here at the Engineer and Research and Development Center as well as this group for water resources that contributed to this report and I want to make sure that they get a little hooray out there with all of the stakeholders and recognition that we could not have done this alone and that it took a big team of multidisciplinary scientists to be able to pull this off.

On the next slide, what we will do is launch in to the actual study report itself. We attack the natural and nature-based feature project from an engineering perspective. We need to fold in how one might there about implementing a natural and nature-based features within the planning framework that you've seen this far.

We talk about things like organizational alignment, how we get the stakeholders on board and start talking to them in getting that contribution. Then, we go into an evaluation section and they will probably talk about how one might design these things and then, implement them and evaluate how or compare and contrast which solutions might be more effective. The last part of the report talks about case studies and how implementation has worked that for or how we might go about laying new designs.

All of this looks like the impetus on sustainability with the concept of [just billing it 00:43:56] and with adapted management in play. Arguably, some of these natural and nature-based features are sacrificial in nature. They're likely to take the first hit when the storm comes in and then, they will have to replace or brought back to a level of functionality. That's where our adapted management comes in play.

On the next slide which is NFA is our first several chapters. They focus on characterization of natural and nature-based features using cross sectional diagrams, discuss the hematology and the vegetative composition of these areas all chosen by ... Or related to functionality and how one might go about fixing wide mapping of these features so that we could start looking at possibility where one might put nature and nature-based features.

Now, there are associated costs that we focused there from literature. Other studies that are out there and so, we put those into our report as well. Then, on the next page, we go into an assessment of vulnerability. As Jason indicated, there is the likelihood that climate change could have significant contributions to

the vulnerability of this area and so, we need to take into account and start insisting how natural and nature-based features possibly could be more resilient in the phase of climate change.

How one might go assessing the vulnerability of natural and nature-based features is the focus of our second chapter. We have a series of suggestion metrics that could be used, actually present there an assessment protocol to quantify the vulnerability. We will end here at the end of that chapter an assessment of resilience and how natural and nature-based features might improve or enhance resilience.

One of the things that we talked about is a community self-assessment. On the next slide is an example of what one might do in a workshop setting with a series of stakeholders on a region where we ask them their perception of how exposed they are, how sincere their infrastructure is and then, how one might go about adapting and recovering and even doing long resistant using natural and nature-based features in combination with built infrastructure.

On the next slide, we want them to do evaluation aspect of the natural and nature-based features with the concept of ecosystem's goods and services. We use a definition that has been basically adapted for our efforts which talks about the idea that these services and goods are tangible or intangible features, their commodity can be generated by self-regulating or management assistance.

This composition structure function [inaudible 00:46:59] the natural, the nature-based and the structural features combined to produce socially valued benefit that can be utilized either directly or indirectly to promote human well-being. The idea here is that ecosystem data services can be derived from built infrastructure, natural capital or combination of the two and that we can move ecosystem business services as a way of simply valuing or depicting their importance or their desirability to the society.

The ability of ecosystem business services to be provided is dependent on critically disciplined processes tied to structure function either alone or in comfort. Now, you needed to generate a series of metrics based on how much time and effort and resources one might have. We started out with the concept of qualitative characterization of performance where you could agree to the experts in the room and you ask them to rate out and rate the value of the performance of the natural and nature-based features on the series of services that might be provided.

They actually came up with the list of over 21 separate ecosystem business services that stay on the [dam 00:48:22] of recreational benefits, educational benefits but also, the storm management reduction benefit and we tie this in

[inaudible 00:48:30] to no less than 30 natural, nature-based and built components that would be combined in this vision.

As the second step, at the [key-key 00:48:41] analysis, we prepared a coastal mapping exercise. Well, you actually start limping the ecosystem's structure and function, see the processes. Then, learn different services that are provided and the benefits and the values that might be perceived as a result of those benefits.

We matched those out in terms of coastal mapping. How one might come up with the period of proposed solutions or features together to generate the desired results or the planning day suggested. At the third level or tier three analysis, what we propose is quantitative characterization performance. It came up with a series of ways to do this.

One of them is value transfer, basically finding dollar value to the ecosystem businesses that they are going to derive or as an option to regenerate the series of ecosystem production functions using GIS and we generated 72 individual performance metrics that can be used to quantify the performance of a natural and nature-based feature in combination with blended solution.

On the next slide, we move into evaluation and the ideas to the metrics, the vulnerability metrics and the ecosystem business service metrics and combine them in evaluation framework, the tier one, the tier two and the tier three and we walk into a protocol how one might go about doing now.

In the next chapters, we get case study. We actually suggest that in regional sediment management, one might find a home for natural and nature-based features, we can consider sediment of source for these features and we look at the Long Island Towns feature [inaudible 00:50:26] which is a software package application that talks about where the sources of materials might be and where the placement idea might and comparison tracks with the benefits might be in. It's two different solutions using an NNBF sources.

The final chapter in that section, we have three case studies [inaudible 00:50:47] Jamaica Bay, Cape May Meadows and South Cape, Charles and we did a full out assessment with Ecosystem Business Services to show how one might go about doing so. On the next slide, we talked about that sticking with it, the policy and preparation.

We had a series of workshop. There are a lot to layout the underlying themes. There is a knowledge depths and knowledge and data deficiency imposed a significant drawing for the development of them with some policies on natural and nature-based features. We highlighted that.

Second thing was the fact that we need to communicate and use a lot of outreach to get the point across. Natural and nature-based features a series [inaudible 00:51:31] including the nebulous concepts and new decision makers are not clear on how to use natural and nature-based features effectively and when to use them and when not to use them.

The last thing that we point out is leadership and the implication of coordination with it. The natural and nature-based features are not a solution and they're not [inaudible 00:51:54] and they're not always practical in all application for all the location. We need to have a broad understanding of the characterization with it and we need leadership and dictation to coordinate that application.

Few more slides. The next one talks about the management of the natural and nature-based features and practice. This was basically what the report lays out. We have offers and advance understanding of the fundamental processing. We've discussed and describe the improved modeling systems that can be used to engage with stakeholders and to start quantifying the benefits. We talked in the last chapters about cost efficient monitoring and how one might go about in the long term adapting for managing this situation.

They focused at the very end of the report on the meaning for pilot demonstration site so that we can start working through all of the necessities, all of the hard decisions that must be made to be able to implement and to improve performance on say, with the features. One, last but not the least, they focus on concepts of healthy analysis of layout the idea of using the engineering with the initial program to help us in jump under this and the idea there, the natural and nature-based features are likely to be more dynamic than hard infrastructure were going to have to face that, taken on, and use operations and management, long term monitoring [interactive 00:53:31] management can make this happen.

In my conclusion side, I just wanted to say which is on the next slide, sorry. We are, again, in that frontier mode. There are things that we need to do to exempt the sign but this recorded the first step. We need to organize and expand our science so that we can work out the engineering of these natural processes and features.

We need to reduce the uncertainties that surround the science with natural and nature-based features and we need to start persisting on performance driven data. We need to develop methods that integrate in a fun nature-based features that every access of the recovery efforts, if it all possible and to lay on to the side when they're not.

We need to consider and emphasize that we're dealing with dynamic systems, things that are going to be constantly shifting and changing. Natural and nature-

based features needs to excel in [those seven 00:54:31]. We need to focus on that.

There, it takes a lot of shots to make this work and we needed to integrate multiple disciplines and multiple organizations together. They need to come together, so it would make natural and nature-based features successful. We emphasize that and then, the last one that we always make is that we're looking for the next good study plans to do demonstrations, talk about and to use the power of the story or persuade the non-believers or the folks that are not completely on board.

We need these kinds of case study to be able to demonstrate that they are effective and sure in such situation. I put the website one more time up there, so that you can check their site and get to the natural and nature-based features. Bear with us. It's a very good report and that's just the components to download but that just means that it's chock-full and lots of good information that you can use in future in your [inaudible 00:55:31] recovery report. With that, I am done, Karla.

Karla: Thank you, Kelly. Our next presenter is Dr. Julie Rosati. Dr. Rosati is a research coastal engineer with the Corps of Engineer Research and Development Center Coastal and Hydraulics Laboratory. She has been leading an inter-agency team to develop an understanding and strategy to incorporate resilient assessments and Corp approaches. Julie will be discussing a community self-assessment for estimating resilience which is documented in the NACCS report. Julie?

Julie: Thank you, Karla. Good afternoon or good morning everyone. These are some of the topics that I will talk about in about eight slides here. I will go over what is resilience. We hear that word a lot and it's used widely now. We have been working on ways to quantify it. We developed the method that we call a community self-assessment of resilience. It's highly leveraged from an existing method that's available from NOAA Sea Grant.

We modified it to add some quantification of the method and I will talk about that in a little bit. Then, I conclude with some measures that could increase resilience. All of this work is discussed in the report that Kelly just mentioned in the section in that big report that goes through the methodology, give some examples and how to go about doing these types of assessments. Next please.

Before we talk about the word resilience, one thing that we've recognized is that resiliency really means looking at our coastal regions on a system scale. We can have one piece of a system that is perfectly resilient but that does not mean that we're going to have a positive result within the system.

An example would be supposed you're on a barrier island and you have a seawall in front of your home, well if your neighbor doesn't have a seawall also, you could still have damage and inundation even though that seawall was perfectly resilient and able to damage and perform just like you want it to. Your neighbor, the lack of the seawall there could cause some damages to the overall system itself.

We really need to look at how the region performs on a systematic scale taking a broad view of how the different parts of the system interact and working to align engineering and natural systems. Next slide please. When we think about resilience, as I mentioned, there are many, many studies available. There are many definitions. There's actually around 100 definitions available.

What we see in almost all of these definitions is some characterization of these four actions within the word to prepare, resist, recover and adapt. If you understand what resilience means, it encompasses all four of those actions and it's really a cycle so that through the process of preparing, resisting and going through these disturbances or challenges, you recover and then, you adapt.

You learn from that and you can transform and actually another term we see being used widely is bounce forward, so you not only recover, you also learn from that and become more resilient with time. Next slide please. When we think about this a little bit more in the temple aspect, we can understand resilience a little bit that are on the Y axis, we have the functioning and like I mentioned with the seawall, you know how you want a system or part of the system to perform.

You have a goal when you design that part of the system whether it is to reduce storm damages to specific level or perhaps it's to provide a particular acreage of habitat in the case of a wetland or maybe it's to provide evacuation of the community by a bridge or a roadway. You have a specific goal for that piece of the system that you have designed. Then, you're hit by some disturbance. It could be a short term events like a storm or it could be a very long term event such as saving population growth in an area that you need to be able to understand the challenges associated with those events and recover from them.

Then, you learned from that and you adapt and evolve overtime and that could be by building new projects or maybe just restoring damaged parts of the system or maybe it's just communicating and educating people about how they can better respond to these types of disturbances. The idea of resilience then is that through time, when you're hit by a similar disturbance in the future, you have less loss and functioning and they'll have faster recovery time.

You're able to withstand the damages. You're able to evacuate the community. You're able to provide that habitat acreage that you need for particular environmental feature and if it is damaged, somewhat you can recover more quickly. Next please. When we look at these definitions, we see slightly different characteristics whether we're talking about engineering features that we design and construct or natural features or community aspects of the system.

I will talk a little bit about that here. On the far left, the engineering system, there's a definition there. You could see in all these definitions, we have those four actions and some form of the verb that make up the definition and the thing that we know about hard structures, built structures such as the New Orleans storm surge barrier that's shown in the little picture underneath the left side of the screen, we design this particular hard structures to have reliable performance for given range of design forcing.

Most engineered systems do not naturally adapt. They need human intervention to adapt, for example, to climate change or maybe changing population density or changing traffic slow. They need the humans to come in and understand how they need to be modified. An exception to this rule is engineered beaches and dunes which case those touch of natural systems that are engineered for particular performance, they naturally adapt although the time scales of their adaption maybe a little bit longer than humans want.

We moved to the middle part of the slide when we talk about natural environmental and ecological features. There is a definition there and what we see with ecological features as I eluded to, in general, changes must be gradual for these types of systems to adapt and a real good example is wetlands that can rise and elevation with respect to sea level or water levels but they need time to build that organic and minimal sedimentation so they could phase with sea level.

If change in water level is very rapid, they cannot keep phase with that rise. That's one of the differences that we see in these natural systems is the temple scale is a little bit longer than humans can adapt. Finally, on the far right of the slide is the community aspects and as all of us know, communities have the capacity to learn.

We can adapt more rapidly than any of these other systems than we've talked about. Although when we talked about the need to be look at this resilience on the system scale, we must recognize that pieces of the system have different capacities for change and adaptation. Next please. Getting a little bit more to what we're interested in for coastal systems, here is a cross section conceptual barrier island and what we see is on the left is a bay side of the island. Then, we see some infrastructure in the middle of the island.

Then, on the right side is the ocean side where we see beach and dunes system with some vegetative dunes. As we'd look through some of the literature that is out there on about resiliency for many, many different types of systems even fiber systems and looking at security and safety, different engineering systems, there are general principles that overlap these different types of systems and it's shown in the bullets at the bottom part of slide and I will talk through those with respect to this coastal system just a little bit.

The first one is to evaluate the weak areas of the system and be ready to recover. The example that's shown here in this slide is that we've recognized that this part of the barrier island is narrow so that it might breach and form an inlet during the storm. We have stuck piles of sand there ready to close that breach if we need to, so that the inlet does not grow in damaged homes and roads and infrastructure that is there.

We are ready to respond very rapidly to get back all functionality of that system. The second bullet is to provide diverse and redundant protection and that's illustrated here by the combination of a beach and dunes system and a buried seawall. That's on the ocean side of the image.

If the beach and dunes system eroded passed what we had anticipated in the design, that the buried seawall is there to provide a backup protection to those homes and infrastructure that are on the barrier island. The third bullet is to ensure the availability of alternate networks, the components that are independent of and complement each other.

A real good example of that is our electrical power grid where if one transformer blows, we can reroute the electricity and still provide those services to the community on the barrier island. Another example would be multiple bridges from the barrier island to the mainland so that communities on the barrier island can evacuate.

If one bridge goes out, they still can get off the island and be safe. Then, finally, the last bullet here and these are just representative, good practices, there may be many more. The last bullet says that we need to provide information to everyone involved in this system so that everyone understands how they can best manage the system of resiliency and make decisions about how they can contribute to the resilience of this region.

The example here shown in this concept diagram is that the home owners on the barrier island understand how much protection they're getting from that beach and dunes system and how much risk they may still have remaining after that. They'd raised their homes, so that they recognize they want to be more resilient

safer during the next storms and the next years of level change and other aspects of the system that may change.

They've come up to the plate and raise their homes and understood the information that was available, so that they could make the decisions about what was needed. Next slide please. This gets into a little bit about the methodology, how do we calculate it then? We understand the concept but how do we go about making a calculation? The way we've approached this is to establish two goals for a piece of the system and then, we can roll up all the goals and pieces of the systems so that we can look at it in a holistic manner.

The goals are first, we establish how we want that part of the system to function so that, that goes back into that time diagram we talked about earlier where we had a specific functionality or goal for the piece of the system, maybe it's to provide a particular acreage of habitat for species in an [estray 01:09:19] or bay or maybe it's to reduce storm damages from up to 100-year storm occurrence interval.

Then, we establish a recovery objective and that is in case we can't meet that functional objective, maybe the storm was more severe than we anticipated or maybe the system has changed, there are more people on the barrier island or other aspects of the system have changed. We established a recovery objective that if we don't meet that functional goal, we still have a recovery goal that measures how fast we were able to get back into business that's usual.

Getting people back to their homes, back to operation and back to their jobs just like they were prior to the disturbance that affected by that. Next slide please. This goes through how we would go about that calculation and I've used that conceptual diagram that we talked about earlier and I have established four components of the system.

There is the beach, the dune, a living shore line on the bay and then, a reef in the bay. Each piece of that system then, we've identified how we want it to function? Why we have it there? What's its design? For the beach, it's to prevent a storm surge of a certain magnet for this conceptual example, I've said up to a 50-year storm occurrence.

The dune is there to prevent over topping. The reef in the bay is to break waves in the bay shore to reduce erosion by 10% on the bay side of the barrier island. Finally, the living shore line has a goal that it would reduce shore line erosion by 30% on the bay. That's how we design those features and how we want them to function.

Then, if we're not able to meet those functional goals, we have recovery goals and those are a temporal aspect of the system. If those functional goals aren't met, then we will recover within a certain amount of time. Now, that could be a natural recovery, the beaches and dunes are going to recover on their own just from the natural waves can rebuild the beach or it could be through humans coming back and rebuilding the beach.

Then, you look at data. You could query the experts on that barrier island or in the community or the state or you could look at article data such as how did Hurricane Sandy affect this barrier island or you could have numerical models that will help you understand where those functional goals met and where the recovery goals met.

Based on whether or not they were met, you put a one if they were met and a zero if it weren't. Then, you add those up. The last column of this table shows the waiting coefficient that the sum of those waitings must add to one because you don't want to skew your results, you want to have a total of 100% possible. Those are established by the community.

You get the community's input on how important is the speech to you, how important is this dune and the living shoreline, etc. These are shown here in decimals that they really represent a percent. The beach gives a 25% wait or a .25. The dune, about 30% wait on that, etc.

Then, you take the sum of the S plus the R and multiply with the waiting and then, you sum all those up for the different pieces of the system that you've established and divide by two. You divide by two because you had two goals, so you take the average of those be met whether or not you met those two goals and you get a number out.

Again, 100% would be a perfectly resilient system and a zero would be a non-resilient system meaning that the system would not able to resist or recover. Here, we have a 15% value which is not terribly good, so that might indicate areas that we could improve our system and you can look into that based on whether you have met or not met your functional goal and your recovery goal. Next slide please.

Finally, the report talks about possible measures to increase resilience and we go back to that definition again or those actions associated with the definition and we'd look at what are the ways that we can prepare and anticipate and some of those are shown here and the report discusses a lot more examples about how you could do that.

Then, within the resisting withstand, there are some example actions that you could do to improve your ability to resisting withstand similarly to recover and bounce back. Finally then, to adapt or bounce forward. This whole cycle is viewed just as that, a cycle so that you go back through this assessment, that example that we just went through.

If you did this with your community, you would revisit it perhaps on an annual basis to see how you're improving or perhaps how the system is changing, maybe you have more people there so that you need to look into better evacuation routes to get all of those people off of barrier island. You revisit this resilience assessments so that you understand how the system has changed and also, how the forcing has changed.

How different storms maybe changing in terms of their intensity and frequency. How developments have changed, etc. That summary of the methodology with a very simple example and again, the report has a lot more discussion and examples to go to this type of assessment. With that, I will hand it back over to Karla.

Karla: Thank you, Julie. Finally, I will turn it back to Amy to close out today's presentation with the discussion of institutional and other barriers to comprehensive coastal storm risk management and to summarize the NACCS' efforts that have been presented today.

Amy: Thank you. I will tell those of you who have ... Hundreds of you who have hung in to this long presentation that we appreciate your time and your interest. Our goal is to certainly share this information and certainly that everyone can use it to take these next steps in coastal management. Thank you for listening. We really wanted to provide a window into the depths of the information that we have provided under the study. I have a final three slides if you can hang in there just a bit, I will try to make them brief.

The legislation directing this study also requested an identification of institutional and other barriers. The NACCS includes a full chapter on challenges, successes and opportunities for action for each team. You can see the key themes listed here which range from science to policy to leadership and communications with regards to coastal flood risk management.

I'd like to remind everyone that all the products and reports described today and more including animations even of this flood risk management measures are available at the NACCS' website, please check that out. What does this body of work do for us? It allows the integration of data, experts, research and investments to manage our coastlines to be more resilient and adaptive into the future.

In the box on the left, the Corps of Engineers had contributed through implementation of specific studies and projects to the region. At the same time, the states and others have many ongoing initiative and program. We have aligned the NACCS' products to support the regional efforts of everyone. Going forward, we see the core integrating these programmatic elements in a way that supports coastal resilience on behalf of all stakeholders, not just the Corps of Engineers.

This will enable state, non-governmental organizations, industry, academia, tribal entities and others to make the best investment with their dollars yet in support of an overall approach to the coastal management that involves blended solutions and adaptation planning. This framework and the products are intended to be used by all.

It will enable more robust risk informed decision making for pre-disaster planning as well as climate change adaptation planning. Coastal storm risk is a shared responsibility and NACCS' [arms, states 01:18:43] and communities, those space with very tough choices with the information needed to prepare for the next storm. Thank you. That concludes our formal presentation and I will turn it back to Karla for the Q&A session.

Karla: Thank you, Amy. Thank you to all of our presenters today. Just the final reminder that these slides and the audio from today's webinar will be made available on the NACCS' webpage in a few business days. We will now take some time to answer questions from participant. As a reminder, you may ask the question by entering it in the notes box on the right side of your screen addressing it to all presenters or by selecting the raise hand button on the upper left hand side of your screen.

We do have a series of questions that have been asked in the notes box, so we'll start with that to kick off Q&A. The first was how can we download the slides you were showing us or can we download the slides you were showing us and how? The answer is yes. Again, this will be made available on the NACCS' website probably in the few business days, the slide as well as the audio. The next question, when will the GIS data produced by the comp study be provided to the state? I will ask Dave Robbins, the project manager to address that question.

Dave: Thank you, Karla. Yes. Again, if you navigate through the webpage. A lot of the information, all the technical products are presented there, including the GIS data. There is a feature on the webpage where you can send an email to the naccs@usace.army.mil inbox where we will receive your request and can transmit the GIS data products to you through that form. The data is available. Just send a link via the webpage. Then thereafter, you can receive the zip files containing the GIS data products.

Karla: Thank you, Dave. The next question. Can you describe the methodology for developing future population growth areas? It seem to include many areas unlikely to develop such as wetlands and [cemetery 01:20:57]. I will again ask Dave to address that question.

Dave: Yes, that's a very good question. Thank you, Karla and thanks to the participant. Again, just to remind everyone that ... It's eluded to the fact in her presentation that as far as the tier one evaluation of the completed, at the end of the study area scale, we utilize the various datas that we had available that was consistent across the entire data set.

For this particular example and we're referring to the forecasted population and density development, GIS analysis that was completed and utilizing the EPA's ICLUS data set, we obtained those data and identified from 2010 to 2070, the approximate increase and density development.

As far as that data, we did note that some of the land use included some, for example, [cemeteries 01:21:45] as an opportunity for increase development in the future. That is obviously not the case. We caveat as such and in fact, that was actually encountered from our stakeholder's during [inaudible 01:21:55] that occurred back in March of 2014 that we received in the formal comment.

We added that caveat [linings 01:22:04], but again we wanted to emphasize that this is as far as this tier one analysis, a good start to identify the future conditions with respect to forecasted population density development and then, compare that to the future conditions associated with C level change impacts, so that our stakeholders can understand where in the future as far as tier one, you get a sense to what that change would be. Then, utilizing the framework as far as the tier two, tier three now because again, then you referred to utilizing the framework.

One can really refine the data sets and keep out some of those data sets that are not as clear as it would be doing those analysis. That was definitely noted and we noted the fact in our documentation that there was a caveat to address those. As far as smaller scale we are finding at a higher resolution, that type of inaccuracy would be corrected subsequently.

Karla: Okay. Thank you, Dave. The next question is ... I seem to have missed something important. Some slideshow that you did look at NNBF but the final slide sited only structural and non-structural solutions where NNBF included as part of the structural options and so, how did you quantify the risk reduction benefits? Again, Dave will address those questions.

Dave: Thank you. Okay. For the measures, as part of our collaboration process that occurred early on in the study, we participated with several stakeholders including federal state, NGO's, local government officials in a measured workshop and hosted by Stevens Institute of Technology in Hoboken, New Jersey that occurred on June 2013 and as far as that effort, we looked through our stakeholders to help us aggregate what are all the various flood risk management measures that are out there.

As far as the results of that workshop, we then took the measures and aggregate in various categories. One was non-structural measures. The second was structural measures. There's two categories. In the non-structural measures, that include the policy and programmatic measures and in the structural measures category, that includes NNBF.

If you referred to the main report as part of this aggregation of our various measures into categories, we laid out what those categories would be for natural and nature-based features for example, there are some measures that could be considered both structural and NNBF based on the criteria which they addressed flood risk and as well as our other criteria associated with them including benefits, adaptive capacity, etc.

We categorize them as far as non-structural, structural, structural/NNBF and NNBF. Again, that's included on our main report page 57 if you want to navigate to that page. Ultimately in that, as far as the analysis, the Corps of Engineers evaluated the various criteria that those measures would ... How they would perform for the various flood risk management function including flooding, wave attenuation and erosion as well as benefits associated with them.

Karla: Thank you again, Dave. Our next question. Does the graphics for resilient development indicate that buried seawalls are now part of the overall army cloud engineer's concepts for shorelines directly impacted by open ocean environment or was this just one example? I will ask Julie Rosati to address this question.

Julie: Thank you. That was just the conceptual example to illustrate redundant protection. There could be other ways to have redundant protection. That was just the conceptual example.

Karla: Okay. Excellent. Thank you, Julie. Our next question. Can you say more about the results of the analysis of how NNBF performed in Sandy? I will ask Lynn Bocamazo and Kelly Burks-Copes to address those questions.

Lynn: The effects of natural and nature-based features that have been incorporated today on some Corps projects including beaches and dunes was incorporated in

the performance evaluation study for Hurricane Sandy that was completed in 2013 right after the storm. That study can be found, the document can be found on the NACCS' website at the bottom of the page under important links, USACE Sandy performance evaluation study.

We found that projects with both beaches and dunes perform better than projects with perhaps just beaches alone and also, much better than projects that were shoreline locations that had neither core projects or were in an eroded condition. They did not fare as well as those areas that had Corps projects with beaches and dunes. That information is in that performance evaluation study report.

Kelly: Within the natural and nature-based features report, you will find a chapter dedicated to basically an evaluation of how the natural and nature-based features that were impacted by Sandy? What the ecosystem business services that were lost [works 01:28:23]. What we experience in terms of the lost of ecosystem business services as the natural and nature-based features to come to the storm.

We did not assess like before and after for protection per se, the three sites that they did fixed, they are looking at the habitat values or the ecosystem performance and how the hurricane basically impacted that ability to provide the different services. That's been one of the final chapters in the natural and nature-based features report. Those looks on Cape May Meadows, Jamaica Bay. Those are the ones that you will be able to look through and see how the performance range out or the [inaudible 01:29:06] resolve the storm.

Karla: Excellent. Thank you, Lynn and Kelly. We have several more questions in the notes box. However, I would like to pause for one moment just to address one question we do have through the raise hand function. Tegan, would it be possible to unmute that participant?

Tegan: I am not showing any participants in the queue with raised hands.

Karla: Okay. It might just be a glitch on our end then. We will proceed with the notes questions then. The next question, does NACCS or the NNBF appendix evaluate presence and function of existing natural areas along with [studies 01:29:51] Atlantic Coastline or is the focus on adding additional NNBF to what exists currently? Please, Kelly, would you like to address that question?

Kelly: Sure. Thanks, Karla. The answer is both. We assessed basically what natural and nature-based features are in existence and how it come up with the metrics for evaluating their ability to provide ecosystem goods and services. As I mentioned

before, we assessed the impacts of the form on the existing natural and nature-based features and how those services were lost.

The metrics that we've developed are actually the fine mark, the protocol, the methodologies can all be used to evaluate future opportunities.

The highlighted areas where we think the landscape amenable to a natural and nature-based feature and we can move the metrics that we've developed to help with the courses or management program or if you want to individually, on a side by side basis or even under regional or system level start talking about implementing one of the features and start quantifying the return on investment for putting natural and nature-based features into play. The metrics that we've developed work across the board both to assess existing function, lost function and potential function and performance as the result of a new design for example.

Karla: Great. Thank you, Kelly. The next question. To what extent will the U.S. Army Corps of Engineers be able to facilitate actual implementation of these recommendations through its continuing authorities program? Just a little background, the [CAP 01:31:39] program as an existing authority and appropriation mechanism that congress entrusted to Corp of Engineers to study design and construct smaller scales of civil works projects in the next blending cycle and I will ask Amy to address that question.

Amy: Sure. I am going to combine it with another question that we received which is how do you see the NACCS study being used in Corp projects in the study area? This answer will respond to that as well as whether these projects are through the continuing authorities program or our larger projects, the civil works congressionally authorized projects. We certainly see the study and all of the products as something that all coastal practitioners can use and should consider.

That does not exclude the Corp of Engineers. We see that as a contribution to all of us working in this coastal landscape. That said, I can't obviously say whether every continuing authorities project or every Corp of Engineers projects following the policies that we have would allow for everyone of these features to be incorporated and implemented. I do believe that the Corp of Engineers is committed to considering these concepts and we've also called out in a report, the opportunity for public side at partnership.

We may define on the landscape more comprehensive solutions but it may not be in within one agent be whether that's the Corp or another agency's per view to implement that entire comprehensive plan. We believe this is where the partnerships can be strengthened and there's a lot of opportunity for

partnerships between agencies and risk private sector to implement some of these comprehensive approaches.

Karla: Excellent. Thank you, Amy. All right. Our next question. The NACCS study looks good overall. For the numerical modeling effort and the slide presented here today, just wondering why no confidence interval noted on plot showing return interval? I will ask Lynn to address that question if you're available.

Lynn: Hi. Yes. We have confidence intervals developed for the statistical results. The slide just doesn't show that. We have developed the means, the 68%, the 95% and the 98% confidence intervals for each of the water levels and way site analysis, the statistical analysis. That will be part of the products available for the result.

Karla: Great. Thank you, Lynn. Our next question. Wonderful job everyone. Does NACCS have any legal or policy connections with federal funding sources like the Community Development Block Grant Disaster Recovery? In other words, must local projects being funded with CDBGDR money comply with the findings and/or recommendations of NACCS?

Amy: I believe this gets to some of the institutional and other barriers sometimes that we find in our ... As we work across the coastal landscape that we each come in with our programs to be of assistance but we aren't necessarily linked or required to use each other's tools or methodologies or mechanisms. I would say that no, there is nothing that legally is requiring this.

I would point out though that on page 17 of our main report, there is a diagram that was meant to illustrate how we tried to align with all of the agencies working in this landscape. Certainly the HUD Community Development Block Grants are even listed on that diagram. We couldn't possibly reflect everyone's program but we were definitely showing that with all of us operating in this landscape, it is certainly incumbent upon us to try to support each other's initiatives and use these pieces of information to make decisions moving forward and that's certainly what we tried to do here.

We tried to become aware of everyone's program such that this framework could enhance ongoing actions, initiatives and decision making. It's not meant to replace or to proceed but to enhance and certainly inform us going forward that we might develop more comprehensive approaches.

Karla: Excellent. Thank you, Amy. The next question. Does the Corp anticipate developing any webinar or face to face training that a community could access based on NACCS' procedures? I will ask Amy, again to address that question.

Amy: First, thank you for the question. I think that our vision was certainly to create something that could be replicated and that really was usable and in the hand of communities such that they could understand their risk because then, that certainly fill to the discussion about what to do about it if anything in some areas. I really appreciate that question. Through the conduct of the study as you saw early on, we used a series of webinars to solicit input and to share information similar to this one today.

At this point in time, we have not developed a training program, if you will, but I think that it is a fabulous suggestion. In the mean time and I can't commit to that today certainly, it's a great suggestion to consider. We do through the Corp of Engineers have a technical services program that would allow for that to happen.

There may be other agencies with similar program that could assist in that way with federal funds or cost sharing. If you are interested in something like that, how to take this framework and apply it with your more localized GIS and data, I would encourage you to contact us and we could explore that a little further because I think that it's certainly an end point that we greatly desire through this initiative.

Karla: Okay. Excellent. Thank you, Amy. Our next question. There's a couple of questions here. Will congressional action be required for the Corp to integrate the study results into the course planning process for water resource projects? If so, what congressional action is warranted? If not, what is the expected process and timing for integration? I will ask Amy to address that one.

Amy: You keep giving me the easy one. Certainly, our report was directed by congress and we provided that information back to congress. We do not have specific study recommendations. That was one of the items that we listed early on that this study was not. It did not produce what's typically called for the Corp of Engineers, the chief's report. It does not authorize design and constructions.

For us to undertake specific studies, certainly it does require congressional authorization followed by appropriations. We are not putting to those decisions but we have provided this information as well as briefings to the congressional members and state governor staff that occurred last week. We believe this will certainly inform their next steps and desires regardless of coastal risk management.

Karla: Excellent. Thank you, Amy. Our next question. Does the report include areas where instability and mesh adjustment will require to ensure model stability? I will ask Mary Shalone to address this question. If you could please introduce yourself since this is your first time speaking for all those participants.

Mary: Sure. This is Mary Shalone from the [inaudible 01:40:12]. We were involved in the numerical modeling and statistical analysis portion of the work under Lynn's guidance. With this, the validation process of each of our models includes a title harmonic analysis and a comparison of model to measurement for a series of storm events. During that process, along with that and the production process, we identify and correct any issues we have with the modeling mesh and so forth, so that we can go forward with a stable model.

Karla: Great. Thank you, Mary. Our next question. Wholeheartedly support an ongoing training program to all levels of government and the private sector. How best to promote this idea? Amy, do you have any thoughts on that?

Amy: Certainly, we don't have ongoing appropriation following the study, following the course process once we have our authority in the appropriations and deliver the product that pretty much wraps things up aside from routine, communications and roll out such as we're doing now. In terms of the training program as I mentioned, I think it's a great idea.

I think that's something we would like to further think about and certainly if you have any suggestions or ideas, I would encourage you to contact us and let us know or explore that with us. Again, I would just repeat that we do have some programs available now without seeking additional authorities, we do have current programs such as our technical assistance programs through the Corp of Engineers and again, other agencies I am sure that can provide such assistance on a community by community or state by state basis.

Karla: Great. Thank you, Amy. It looks like we have one more question here. Before we move forward with the next chat box, I just want to make sure we don't have any raised hand. I still show one on my end but again, I think that might be a glitch. Tegan, can you confirm that?

Tegan: Yeah. I can't see any raised hand up in here.

Karla: All right. Great. Okay. Just a reminder, feel free to ask a question by placing it in the notes box on the right hand side of your screen. Please address that to all presenters. You may also raise your hand, that's the upper left hand side of your screen. We got about 13 minutes left for questions.

The next question. Will the U.S. Army Corp of Engineers allow private consulting firms retain to do storm water drainage and management studies using Community Development Block Grant's disaster release money to access this website/report and tools or are they proprietary to the federal and state government?

Amy: All of the information discussed and like I said, and more is available to the public. Anyone who can access that website is welcome to and we want you to download and access the reports and the data and the contact information. It is publicly available. It is intended to be. We see this at the request of congress and a public service to provide these documents and materials. They're there for your use.

Karla: Great. Thank you, Amy. I do not see any other questions or comments in the notes box at this time. One just came in. The next question is what economic methodology reviews as the basis for the evaluation of NNBF? I will ask Kelly, if you're available to address that question?

Kelly: One of the things that we did do economic-based, a monetization was a value transfer method. It's light economics. It's not as serious data intensive evaluation, what we did is pull together in literature from the region that quantified the value of the particular wetland, acreages for example. Then, we did a value transfer of those.

That's not to say that you must do monetization and that's one of the reasons that end up with a tier one, a tier two, a tier three and a tier three expedited into the study transfer approach which is option one or you could do some production function which is a non-monetized approach to quantifying the goods and services that are generated as a result of natural and nature-based features.

Light hand on the economics right now, this is again, one of those frontiers where we need to do a lot more to expand upon the scientific basis for quantifying and this is one of the things that we see for the activity.

Karla: Great. Thank you, Kelly. The next question. How did the study correlates the multiple [dosimetric 01:46:00] data sets available for the entire study area? Was the final combined dosimetry set developed? Mary, I will ask if you wouldn't mind addressing that question please?

Mary: Sure. Because of the relatively short period of time that this numerical modeling work is done, we actually began with some of FEMA. FEMA region two and FEMA region three developed meshes for their studies. We combine them along with any post-Sandy [inaudible 01:46:35] that the districts that were available and ready for us to incorporate. That became what we considered our base condition that demonstrate and everything went forward from that.

Lynn: This is Lynn. I'd like to also say to support this discussion, the details of the modeling are included in the report that's posted. The report is called the NACCS' Coastal Storm Model Simulation. It's one of those really big reports, 200

plus pages that might take you a few minutes to download from the comp study website.

Karla: Great. Thank you, Mary and Lynn. Again, we've got about eight minutes left. If you do have a question, please feel free to enter it into the note box or raise your hand. I don't see any additional questions or comments coming in at this time. Tegan, if I can just confirm that we do not have any raised hands again?

Tegan: I am not showing any raised hands.

Karla: Okay. Great. Well, seeing no further comments or questions, I will ... We do have one comment that just came in. Lynn, I believe you might be able to address this quickly. The numerical modeling is shown as pending.

Lynn: The modeling work has been completed. The posting of all the results as I mentioned before, we're having some security concerns in the posting of that, but the work that is behind it is the details of that work is included in multiple documents' executive summaries and the coastal store modeling simulation report that you can find on the left hand side of the webpage.

Karla: Thank you, Lynn. Okay. With that, we will go ahead and conclude today's webinar. We'd like to thank you for your interest and participation. As a reminder, the report appendices and all the associated products are located on our study webpage. That's www.nad.usace.army.mil/compstudy. You can also find the site by simply googling North Atlantic Coast Comprehensive Study. Thank you all again for your participation and have a great afternoon.