

# **NDRC Topical Webinar: Harnessing Ecosystem Services for Water Management Webinar Transcript**

George Martin: Hi everyone, thank you for joining. Sorry for the inconvenience; we had some technical issues. We're going to get started a few minutes late. I'm probably -- this is George Martin with TDA. I'm probably going to go through the technical instructions in about three or four minutes just to make sure we get everyone on the line. I apologize again for the technical issues we had with the telephone line and we'll get started in a few minutes.

And I'd like to remind everyone to please mute yourself, you know we're probably going to have 50 or 60 people on this call so just remember to mute your line. We'll get started in a few minutes. Thank you.

George Martin: Hi everyone thanks for joining us this afternoon. My name is George Martin; I work for TDA. We are a HUD technical assistance provider. I want to apologize again for the technical issues that we've had today in terms of getting people on the phone line. It looks like hopefully most of the folks who are on the webinar also got the instructions to use this alternate conference line so we're going to go ahead and get started. Again thanks for your patience and we'll get started here with the content in a few minutes. Before we started that I wanted to just go through some technical instructions for today's webinar.

Today is an NDRC topical webinar and the topic is Harnessing Ecosystem Services for Water Management.

So I want to remind everyone to please mute your phones. I'm already hearing a lot of background noise. So if you could mute your lines we could all hear the presenters when they get started, we would appreciate that. Also, please remember to turn off other phones and close other programs on your computer and give your undivided attention to our presenters today. If you have any technical problems obviously you've already had those, feel free to call Vicki Grimm at the number on the screen or you can send a chat message to the host. The host name is Sandy Patel, but that goes straight to me. And I will do my best to help you get that worked out.

So you're not muted today because we're using an alternate conference line, which is why I keep reminding everyone to please mute your line so we don't hear any background noise. You will be able to ask questions in two ways. We're going to ask you to hold all verbal questions until I believe Lynsey will ask you to hold all questions till the end of all of our presenters are done speaking today. But the other way you can ask questions while the presenters are speaking is using the Q & A tool on the right hand side of your WebEx screen. So in order to use the Q & A tool, all you need to do is type your question into the box in the field, in the Q & A tool screen and then you're able to ask the question to a variety of different people. Please make sure that you send the question to all panelists and then press send.

You'll also be able to ask verbal questions. The slides I have up here relate to using -- using another tool but I think what we'll ask you to do is if you have a verbal question that you want to ask please click on the little hand icon at the bottom of the participant screen and that's sort of the equivalent

of raising your hand and then at the end of all of our presentations we'll know that you want to ask a verbal question and we'll call on you to ask that question.

So even if you submit a written question our presenters will answer that question over the phone line. And just know that if we don't have enough time we might not be able to answer all questions and we'll try to answer more common questions before specific ones.

And as with all of the NDRC webinars if you have questions that you don't want to ask over the phone or in public or if you have additional questions we didn't get to, or if you have questions about the NDRC NOFA, those are not going to be answered today; so you can feel free to send all those to the email address that's on the screen now, [resilientrecovery@HUD.gov](mailto:resilientrecovery@HUD.gov). And with that I'm going to turn it over to Lynsey Johnson from HUD.

Lynsey Johnson: Thanks so much George. Again, thank you everyone for bearing with us through the technical difficulties. I want to welcome you to the Harnessing Ecosystems Services for Water Management webinar. My name, like George said, is Lynsey Johnson and I work with HUD's office of economic resilience. Thanks again for joining us; this is actually the eighth topical webinar in our climate resilience webinar series.

This series is running concurrently with the national Disaster Resilience competition. We hope that the series is really an opportunity for communities to learn more about the 90 components of climate resiliency planning and projects. And just a few reminders these webinars provide tools, best practices and ideas that you may use but you really should tailor these approaches for what really works best in your jurisdiction.

As George had mentioned if you have any NOFA NDRC specific questions please email [resilientrecovery@HUD.gov](mailto:resilientrecovery@HUD.gov) and also I want to make sure I highlight the fact that all these webinars, the recordings, presentation slides as well as the transcript of each of the webinars are going to be -- they are archived on the NDRC webinar website on HUD exchange.

Today we have four subject matter experts joining us and I'm really thankful they were able to work with us today. Chad Berginnis is the Executive Director of the Association of Safe Flood Plain Managers. Kate White will be presenting and she is an engineer with the US Army Core of Engineers. Bob Newport is joining us from Chicago and he is with the National Pollutant Discharge Elimination System Programs with the Office of ETA in region five. And finally we have Joanne Thorough who is the Director of the University of Maryland Environmental Finance Center.

Each of these individuals will kind of have a section of the agenda here. Chad will talk a little bit about flood plain management, kind of giving a 101 and overview. And then Kate will talk more about the core -- core's approach to coastal risk reduction. Bob will talk about green infrastructure and then finally Joanne will finish with green infrastructure, financing and some best practices.

And as George mentioned we're going to have questions at the end. If you guys have questions about acronyms or other you know, timely issues that pop up please feel free to enter them into the Q & A function that George had pointed out and then we will also ask or address all major questions at the end. We'll first turn to the chat box function on the side to address questions and then we'll turn it over to the phones if there's any verbal questions; so with that I'm going to turn it over to Chad from ASFPM and again, thanks again for joining us.

Chad Berginnis: All right, thank you very much Lynsey; can you hear me okay?

Lynsey Johnson: Yes we can.

Chad Berginnis: Okay great. Good afternoon everyone. I think even for the folks that are over on the Pacific Coast we are at least past the noon hour. My name is Chad Berginnis and I am the Executive Director of the Association of State Flood Plain Managers. We're a national non-profit organization dedicated to reducing flood losses and also recognizing and promoting the natural functions of flood plains. So as an organization we do have 35 chapters covering 41 states; so hopefully most of you are coming from a state where we do have a state ASFPM chapter itself.

What I'm going to talk about today is an overview of flood plain management and talk a little bit about the strategies and the tools that can be used to effectively manage flood prone areas. Now if you hear nothing else from me today and get no other take home messages, the one I want you to have is this, is that it is impossible in a community setting; it is absolutely impossible to manage flood plains effectively simply using one approach. Flood issues in this country are very complicated and as a result it takes multiple approaches, especially if you're striving for a goal such as resiliency in managing those areas.

So what is -- first of all what is that definition of flood plain management? And what is also the definition of a resilient community? So I have the definitions there; I won't read those but in their natural states flood plains have an enormous but often unrecognized value. They're complex, they're dynamic and they contribute to the physical and biological support of water resources, living resources and cultural resources. They're important to the nations water resources because they provide natural flood and erosion control, help maintain water quality and contribute to sustaining ground water supplies.

Flood plains are by definition these lands that are formed by continually subject to the inundation of water. Depending on location topography soil and weather conditions, flooding can take a variety of forms. Throughout the history of the US the prevailing view is that humans should use and modify the natural environment including flood plains to meet their needs. For centuries people have been settling along the banks of countries, rivers, our streams and oceans taking advantage of the water supply transportation and energy sources that they provide. Unfortunately though this same development has results in flood damage. In fact, flooding today is the nation's primary hazard in terms of cost and damage. Average annual flood loss now exceed 10 billion dollars per year.

So flood plain management, I like to say is it's really defined as a decision making process to achieve the wide use of the nations flood plains. And you have to do that by not only focusing on loss reductions but also the preservation and restoration of the natural resources of flood plains which will in turn, lesson the damage potential. So we like to say at ASFPM that if you're effectively managing your flood plains you will be a resilient community at least from the hazard of flooding itself.

So now what I'd like to do and spend the rest of the time that I have with you is to talk about some of the different strategies and tools for flood plain management. And all the tools are organized under four different strategies and you will also see some repetition in a few of the tools because they can apply to multiple strategies. But again I point you back to that key take home message and that is at a community level you need to apply multiple strategies to effectively manage your flood plains and become truly resilient. So if you're a community out there for example that is only

depending on the national flood insurance program and you think that because you identify peace standards you're resilient; unfortunately you're wrong.

Similarly if the only way you're managing flood risk is that you built a giant new levy or a flood control project and you're doing no other aspect to manage flood risk again you're also wrong in terms of being able to have a resilient way of managing going forward. And so we'll talk a little bit about some of these different ways of doing that and how they interplay with each other.

So the first one is modifying the susceptibility to flood damages and disruption. And again you see about six different bullet items there in terms of how that might be done. And this is one of the more commonly -- common ways to manage flood risk in the United States. So we have over 22,000 communities in the country that have adopted minimum land use standard to be as part of the national flood insurance program. Fewer communities maybe have zoning or subdivision regulations. About half the country has building codes that may or may not have flood construction standards in there. But then there's also ways to do this as well. Things such as acquisition and relocation or flood proofing; these are typically those types of projects if you've ever dealt with a flood disaster. These are the types of projects that a lot of times FEMA will fund, HUD will fund through CDBG and others to actually take at risk buildings and make the risk less, whether it's totally removing that risk by acquiring and demolishing of structure or flood proofing it.

A community having good development and redevelopment policies; this is also key especially in a post disaster situation. My own background, I was a local planning director as well as a flood plain manager and I also did the same at the state level. I can recall many communities in the post disaster situation that were ready to waive rebuilding requirements and all in the name of getting things back to normal as quickly as possible. And by having good redevelopment policies, thoughtful policies to help guide a more resilient redevelopment is really what we're aiming to do. Flood warning systems, those have improved tremendously over the last couple of decades and with some of the internet based communications tools that we have they even become more effective. And then finally good old information and education. Hopefully your community's flood plain manager can be a good resource for you in terms of identifying maybe some appropriate types of strategies to modifying susceptibility.

So one example I'm going to use and I'm not going to belabor this one too much because I know one of the other presenters will be talking about this specific technique. But this is a project I was involved with in Cuyahoga Falls, Ohio and where we had a -- we did have a flooding event that occurred in 2004, a pretty severe flooding event in that area. Of course it's a very -- it's a very suburban type location with a high density of housing. And in this particular area it was just a small water shed, a small drainage but due to the severe rain fall and run off resulted in over \$100,000 of damages and flooding up to nine feet deep for about four or five homes, which was the low point in the basin. So essentially what was done here is using the FEMA hazard mitigation grant program there were acquisitions and demolitions done to where these four homes were -- the parcels were acquired, the houses were demolished and then the community went another step and they actually turned the area into a community amenity being both a park and a community area rain garden. So this has been in place since 2008 and it has withstood subsequent large rainfall events. And again this is one of those ways where sometimes people hear about some of the programs or think about, okay we can acquire and demolish a property, well all we have is a grass lot that needs to be mowed and in fact, you can turn those into community amenities that achieve multiple objectives.

And of course a more typical type of way of modifying susceptibility of flooding is elevating at risk homes and so this is a picture that I had taken in the sandy affected area in a coastal area. This is actually being lifted in a brand new foundation system put in place underneath the home to withstand velocity flooding; it's in a what's called a V-zone.

So then the second strategy is to actually modify flooding and you know in the United States we've been doing this for well over 100 years in terms of doing a lot more of the engineered approaches. Some such as Danzen reservoirs, dice levies, flood walls, channel alterations, onsite detention and so on.

And with all of these approaches, again these approaches can result in lower flood damage, but it is also one of those things that is a community you have to be thoughtful in terms of what the flood risk is that remains and also -- and I go back to the definition of what resiliency is. Are these approaches resilient? Because usually with large engineered structures the two things that you have to keep in mind if you're considering those is one they have a particular design standard that they are built to and if you have an event that exceeds that design standard you do have to worry about the structure being able to handle that event. Then secondly, most engineering structures need some sort of longer-term operations and maintenance. Again, going to the definition of resiliency is being defined as something that requires minimal outside assistance. And so from the standpoint of operations and maintenance if such a facility is being contemplated is the community willing or able to step up and continue the ONM for that particular structure?

And so you have a few pictures here for instance the larger picture is of a Owyhee Dam releasing a lot of flood waters after some of the big Missouri River flooding in 2011. But there also are some approaches, and this is why the strategies you can use elements of these and combine those. And I want to talk a little bit about Yuba City, California. And in Yuba City the project that they had done is that they have -- they had previously developed a levy system in this particular area. And California has had a long history of building and maintaining these levies for flood control along rivers and streams to reduce damages to its expansive cropland and growing communities in Yuba City. You've got three major rivers, the Yuba, the Bare and the Center that brought these critical resources and devastating floods to the region dating back to the early 1800's.

In 1986 a levy break on the Yuba River led to flooding that damaged or destroyed nearly 4,000 homes causing 22 million dollars in damages. And those events led to communities -- led the community in the area to rethink how the floods should be managed. And in so -- just replacing the levy where it was and in the same kind of levy the concept is to make room for the river and incorporate national flood plain lands and habitat restoration into the project design. So not only does the project take advantage of natural functions of the flood plains but the levies themselves can be often built and maintained at a lower cost because they do not have to accommodate as much flood velocity as if it were directly along the river. And so the Yuba City levy set back project does incorporate a levy but also now reconnects over 600 acres of flood prone farmland to the flood plain. The project resulted in 9,600 feet of levy setbacks and the result is that the levy now provides adjoining communities with 200-year level flood protection. The levies themselves are truly engineered and constructed versus old rubble piles and the way levies were built when they really weren't engineered. And also the set back levy has resulted in the flood elevations being lowered by about three feet because there's much more storage area in the particular system.

So again you can have a structural approach but incorporate some of the other approaches to do things such as set back the levies to again make the community more resilient. So strategy number

three is modifying the impacts of flooding on individuals in the communities and of course I think probably one of the most familiar things that the public knows about is the national flood insurance program and flood insurance. But we also have this is where you have things like long programs, disaster assistance, tax adjustments, information and education, pre and post disaster recovery planning. And in fact I know as part of this competition one of the things that is a starting point are the unmet needs from the particular disaster that your community has faced. And so hopefully some good amount of post disaster planning has helped inform that a little bit.

So I want to talk about a few specific ways that this strategy can be implemented and talk about three specific examples. One of those has been the small community of South Holland, Illinois. And in South Holland it's in the greater Chicago land area, population about 25,000 people but they have for a couple decades now had an ongoing flood rebate program where they rebate up to -- the cost of a flood reduction activity up to \$2,500 on a particular property.

So for instance if a property owner wanted to -- if a property owner wanted to install overhead sewers to deal with basement flooding, seal up the foundation or have foundation flood walls and things like that that they could do that. So again you don't have to be a big community to implement programs such as this.

Now in a lot of communities throughout the country you do have for instance local income or property taxes. Certainly you have that in most states as well. Well the state of Colorado actually has implemented a wildfire mitigation tax rebate. Now I'm a flood guy but I am talking about this program related to wild fire because it's easily adaptable to any hazard really, whether if you face flooding, if you face wild fires a threat, if you face earthquake as a threat. The point is you could create a program or change your policies to have a -- to allow for tax rebates for doing these long-term resilient sustainable type of activities to reduce risk.

And then finally one of the more recent programs that was just set up this past summer is the short up Connecticut program which provides low interest loans in the coastal flood plains of Connecticut for not only residential properties but also small businesses to do things such as elevate properties or flood proofing or those types of activities. So again whether you're at the state level, whether you're at the community level you can implement these kinds of programs and activities and compel, I think, the citizens to do more to become more resilient.

And so the fourth item that I'll talk about is really to protect and restore the functions and resources of flood plains because again I don't think you can have a credible discussion on resiliency especially in dealing with the hazard of flooding if you're not paying attention to the flood plain resource itself because the ability to recover from an event is also dependent on the health of that flood plain eco system as well as the different amenities and things that they provide. In fact I remember seeing some of the finalist designs I believe in the rebuild by design competition and you know one aspect that I noticed in all of those finalists had is to recognize the flood plain resource as an amenity and to take care and make sure that that resource is being protected and enhanced.

So what are -- again what are some of the techniques that are used? One of the more interesting ones that I think is the use of conservation easements. So this may not be in the more populated areas but again where you have flood plains you have a lot of areas that drain into those flood plains. And so especially in inland areas, in the upper parts of water sheds a conservation easement which basically pays some use and allows some usually open space uses on a property, but the

easement is purchased to keep that area from being developed maybe and that water shed hardened and all that extra storm water and stuff coming down there.

Good land use planning and again, focusing on the resource itself such as the protection and preservation of wetlands and coastal dune systems and things like that are also important here. So a project that I thought was really neat was something that was done at Colorado State on the campus of the Colorado State University in Ft. Collins. In July of 1997 record localized rainfall at the west side of Ft. Collins resulted in severe flooding that swelled Spring Creek, killed five people and caused millions of dollars of damage. During that rainstorm flood water sheet flowed onto CSU's main campus, traveled through the campus to the east flooding buildings and causing approximately 150 million dollars in damage. After the recovery efforts CSU renovated damaged buildings and constructed flood walls, berms, the low-grade storm systems and provided other improved flood protection to the university. Since 1997 the university has invested over five million dollars in flood mitigation measures and drainage improvements. And so what you see here is a map of the university and hopefully you can see the shaded area that's the flood plain. But what I really liked and I had taken a picture of this --

Is that one of the techniques that was used was actually they did some campus facilities master planning and they actually did land contouring to lower the ground elevation in some of their open spaces. So again when you look at the area that's circled and you have the red arrow pointing to this open space, the -- this photo is viewing out over that open space. So they found the largest open space they had, they did a lot of contouring and excavating, lowered the land elevation by about six feet and created a vast amount of flood storage area that not only serves the purpose of flood loss reduction but also becomes then a recreational amenity, a green space for the students there to utilize. You can see further off there's a soccer field down there as well.

So at the end of the day again there are multiple techniques used to manage flood risk and for communities to be more resilient to the hazard of flooding and I hope that I've at least wetted your appetite in terms of some of the techniques that are available to your communities and certainly I know our contact information is at the end of the presentation. You know we at ASFPM are more than happy to answer any questions or provide any assistance that you may need. Thank you very much.

Lynsey Johnson: Great thanks so much Chad. Just as a reminder everyone please make sure your phones are muted so that we're not interrupting the presenters and everyone else on the webinar. Next we're going to turn it over to Kate White from the Core.

Kate White: Hi, can you hear me okay?

Lynsey Johnson: Yes we can.

Kate White: All right, good. Thank you Lynsey. I want to thank everybody for inviting me here today to talk about the Core of Engineers and I really appreciated following Chad here because when he listed the four different methods that ASFPM suggested, I think that the Core is often associated with number two, which is to modify the risk of flooding to structural measures. But one thing that we're really dealing with more and more these days are the options one, three and four modify the impact of flooding on the individuals in the communities and other land use planning, zoning, flood plain management and all those kind of things.

I want to talk a little bit about that in the context of climate preparedness and resilience. So let me see if I can get this to advance properly. All right, so my outline is if you consider for added patient measures, as you're thinking into the future each different kind of approach has a trade off and I'm going to agree again with Chad that there's no one solution. That multiple approaches must be used; we have to consider redundancies, we have to consider resilient approaches. I want to talk a little bit about the continuum of adaptation and how you might tailor different forms of adaptation to your community or to your region. And the fact that with adaptation we're talking about long range planning and implementation, potential changes to the kind of flood plains that we've seen in the past.

Second thing I want to talk about is it's not all about extreme events when we consider adaptation or resilience itself. So there are things that are happening right now that are impacting how we experience flooding. One of these is continued development in vulnerable areas. Another is potential changes in sea level and storms in the future. And a third is the fact that our budgets are getting tighter and tighter and this will impact the kinds of measures that we can put in place to reduce risk.

Finally I want to talk about the different kinds of measures that the core is using. Again this relates to Chad's one through four. We have natural nature based methods and non-structural methods, structural and combinations of the above and I'll talk about those in detail when I get there. But I think that this is a really nice supplement to what Chad from ASFDM just spoke about.

So next this slide on the graphic on the right contains a graphic from the latest inter-governmental panel on climate change or IPCC working group two report that was just recently released and basically what it's telling us is that we have opportunities to make decisions to increase our resilience to potential changes in the future and so the idea here is where we want to make decisions is things that put us in this red circle area up towards the green and high resilience and low risk for the possible futures that we have. And again you can see by this that even if we start off in an area that's maybe less resilient we can still make decisions that move us to more resilience in the future. So it's not all or nothing and it's not just one decision that gets made. But one of the implications that we need to take into account here is that we have to think about the trade off between resilience considering overall system and that bit is really individually focused, all right so we need to really balance these. We have to understand that there's a trade off so just kind of as an informational point of view. And of course the IPCC does have good information on this and I've included in the notes pages for these slides the references that you can go back to, for example this quote here.

So next the idea that there's a continuum of adaptation measures that can be taken and what I've done here is the underlying graphic is again from the intergovernmental panel on climate change, assessment report number five, working group two which is a group that is dealing with adaptation; that's online. You can just Google that and you could come up with this if you look at the summary for policy makers you'll see a really nice lay version of the kinds of things that these -- this international group feels is important. But here in looking at this background graphic you see on the left transformation moving through adaptation, moving through vulnerability and exposure reduction. And if we think about the kinds of change that you need for transformation there may be more feasible to transform an area and change the culture and change the institutional nature of that area if you have low technology and you're less developed economy. In other words you're not so tied to this particular place, this particular configuration. It might be easier to do -- also if you have a more coherent population, your governing structure is strong and it's not a very large area; so that's kind of over in the left hand side of the string.



Then over on the right hand side when vulnerability and exposure reduction which can be very complicated, multifaceted and extensive those might be more feasible for communities that are high tech, that have lots of money, well developed economies. But it could be difficult for them to do if they're very diverse, if people don't agree on the kind of solutions that should be taken. If there's different levels of governance at all dealing with the kind of measures that you might want to take, or if they cover a large geographic area with different characteristics. So the kind of summary of this slide is you've got to tailor adaptation approaches to your local region and you need to consider the characteristics of that region in deciding what might be the suite of measures that would be useful for you.

So my third slide here especially with respect to what our resources management is long range planning and implementation is key. And that's because the water resources infrastructure we're looking at really long time periods to both plan and design needs and then to construct them. And then the service life of water resources infrastructure is very long. Often they're in service beyond the design life so if a typical design life is 25 or 50 years some of this infrastructure could be in place for 75 or 100 years. And what we're seeing as we look out towards the future for water resources is that we're seeing increasing severity of climate impacts whether that's through changing sea level, changes in storms, altered precipitation trends, changing snow melt or increased drought, which probably you're not all that concerned with, but I am. What we see is that we really have to consider that climate is changing over time and that's going to impact our infrastructure needs to be able to flexible and adapt over time.

So next just to give an example of preparing for the long term when do you make these decisions? Do you make them today? Do we have 20 years? Do we have 50 years? So my example that I'm going to give here is sea level rise and I'm going to give an indicator value on the Y-axis, this will be some indicator value. Perhaps it's the threshold elevation at which local flooding begins, okay so that's where the dotted line is. And then next if all else works okay up comes the fact that I am monitoring and recording values of perhaps mean sea level, perhaps mean higher high water but some value that I'm monitoring and then the green point is today's date. But what's going to be happening in the future here? If we look forward in the future there's a range of projected future conditions that could happen with my sea level. It could be the one on the left, it could be the one in the middle, it could be the one on the right. We don't want to pin ourselves down to one right now because we don't know what that future looks like.

So what we do then to help us make a decision point is we identify the length of time that we need for lead time to plan, design and construct the measure that we need to have, whether it's constructing a levy or a sea wall or a beach or a wetland or a man grow forest that will help deal with the problem that we have. So when I say construct I'm not always talking about pouring concrete. It could be the idea of that detention basin area that Chad just mentioned at CSU. So in this case this lead-time tells us when we have to make our decisions. So in this case the decision -- the initial decision based on this range of conditions that's expected might be here on the left hand side but you notice that as we're moving along in time we may be tending to move more along this third curve, the farther out curve and that means we can move our initial decision point out based on the observations of condition. So we do have choices in when we make the decisions but we do need to consider that lead-time, we have to have understood what the cost is of the adaptation measures and when we need to put it in place. That's kind of the background I'm planning for the long term.

Now people tend to talk about extreme events because they really kind of capture people's imaginations, they're on the news. But it's really not all about extreme events and we have to consider that particularly when we're talking about natural infrastructure. So there's a continuum of opportunities here. One example I'm giving here now on this slide is that in June and July of 2009 along the eastern US sea levels were much higher than normal and it wasn't because of a large number of storms or any major -- one major issue that caused this flooding. It was that the north easter storms they're a little bit more north easter than usual and also the Florida current which moves the water along the coast line was kind of stuttering a little bit. So the combination of those two things neither of which would be enough to cause flooding by itself caused this flooding along the East Coast which did end up causing a lot of economic damages. So again it's not all extreme, it could be something like this.

The next thing I'm going to use for an example is a recent report by Noah on sea level rise in nuisance flood frequency around the United States. I've got a URL here so you can get this report for yourself, but the idea here is that nuisance flooding is increasing because sea levels are changing in the US. I encourage you to read this if you're in a coastal community. The pictures on the upper right labeled C and D are for Atlantic City, New Jersey and on the left picture the number of flooding days per year is shown and those pink and yellow bars show the days of flooding and the duration of flooding. And what you can see is between 1920 and today we're seeing an increase in both the flood hours and the days with flooding. And if you go to the next graph marked D, again we're seeing that increase in the days per flooding over time. If we look below that one and we look at the return period in 1950 those little dots around the country are different tie gages for which the study was performed; and if you look at the dots that are the green, yellow and red -- the light green, yellow and red those are the dots where the return period was less than a year. In other words on an annual basis you would expect to be seeing nuisance flooding.

Now move to the bottom one, return period in 2012 what you see here is that they -- again, the light green, the yellow and the red are the return periods of less than a year and what you see is a very different picture. A lot of reds in this picture; that means that the nuisance flooding, the annual expected floods are really increasing around the United States. This is nuisance flooding, it's not -- it's not extreme floods but it's definitely accumulates extreme level of damages. Sometimes else to note is kind of on the bottom left is that these aren't -- these are occurring at different seasons in the year. So seasonality is important especially when you consider the kinds of storms that you might be experiencing. Again, just factors to consider when you're thinking about adaptation and reducing your flood risks.

So the next slide is that as Chad said no one solution. Integrated approaches are important. We need to consider all the possible options. So the core of engineers we've been looking at integrated approaches for a long time. The Jadwin report to Congress after the flood of 1927 said, "No we don't think you should be building more dams. We don't think you should be building more levies. We don't think the levies should be higher; we think they should be set back and we want to require flood plains to carry the flow". And that system that was designed after 1927 was robust to the floods of 2011 because of this idea of flood plains carrying flow.

A more recent example would be the Mississippi Coastal Improvement Project after Hurricane Katrina. Here we were really looking at many different ways to increase coastal community resilience partly due to restoration of barrier and near shore islands. Partly about moving private lands into the public specter, buyouts, relocations, altering the locations of where people were just as Chad spoke about in his talk. And also with integrating approaches you're considering the use of

natural systems, those wetlands, those natural beaches of undeveloped areas and nature based measures; these are measures, which really take into account nature processes. These could be constructed and engineered beaches. Both the natural and the nature-based measures can improve your resilience and it also adds to your economic ecological and social systems base.

Finally multiple lines of defense are really important. Again, the idea that there's no one solution. So here's an example of multiple lines of defense on the top, you see that we've got the elevated building, you saw some pictures of that. We had evacuation, we have pump stations to remove interior drainage, maybe a levy, maybe a flood gate, a highway that's elevated and on and on as we move from left to right off the coast. And then in the bottom picture you see with surge and you see how the surge changes over time and how these different multiple lines of defense may be useful or not useful and how you might alter them to improve your resilience. One thing that's very important here is the quantification of how natural nature based systems perform, how they reduce the risk. That's a critical knowledge gap that people are working on now really to try and figure out how do you design a wetland or design a man grow forest or design a marsh land bridge to help reduce risks.

So for the core we put out a report on the URL below, it was called something like coastal risk reduction and resilience and the full portfolio of measures and that's what we really try to consider. What are all the different measures that we could be using? So for natural nature based infrastructure we're considering things like the dunes and beaches, some of which are natural, some of which we've engineered and constructed and continue to add to over time, vegetated features, oyster and coral reefs, barrier islands, maritime, forest and shrub communities like the man grow forest and things like that; so there's a variety of different ways that you can use natural nature based infrastructure to decrease coastal risks.

Next the non-structural flood proofing measures. I think this is an area where Chad stressed and I would stress as well but there are a lot of things that we can do that don't involve changing the landscape and investing large sums of money with the required ONM out over time. So the idea of flood plain policy and management, flood proofing homes, you know relocation. I think we've got to find a way to -- instead of calling this relocation call it a fresh start and figure out how communities can make a fresh start in a way that improves their resilience and it also improves their economic well being at the same time that it reduces the overall national requirement to pay for repetitive flood losses.

So next I've got a picture of non structural flood proofing, a fairly simple document that was put out by New York City after Sandy and they really kind of point out here that if you elevate equipment it could be high cost but it's also high resiliency and effectiveness. These kind of little dials are the resiliency and effectiveness and the cost is by the number of dollars. So if you go down to sandbags low resiliency, low effectiveness, low cost. So these are the kind of things that you might be considering for flood proofing and non-structural measures and then you can start to construct a matrix of potential solutions and then look at the budget that you can afford now and in the future.

For structural measures Chad covered these fairly well. We had the levies, we have storm surge barriers, we've got sea walls along our islands, we've growing's that reach out from the beaches to protect beaches and to interfere with the movement of sand along those beaches. We have the patch breakwaters, we have other kinds of structural measures, but this is only one of the kind of solutions that people need to consider when they're thinking about adaptation.

The idea of combined approaches is something that we've been looking at quite a bit lately and I think that the city of New York document that's referenced on the left side of this picture is really worth looking at, it's a post Sandy look at how you might combine these different measures and different kinds of locations. So if I'm looking at the center graphic the Y-axis goes from low development or low urbanization to high urbanization. And if I look at the X-axis I'm thinking about sea level changes where the left side is current today and the right side is the future or more sea level change. And the same as the storm impacts, low on the left side, high on the right side. What you see is and this is just notion, we don't have any good facts on this yet. Is that the greener the natural type infrastructure seems to be more suited to the less developed and less intensively impacted, you know the sooner rather than later sea level change in storms. But we need to know more about this in order to effectively use them to reduce that increase in nuisance flooding that we're seeing.

The purple area, the non-structure flood proofing that's useful in about every case; so that's really the first thing you should be looking at. And then you see at the browner colored things here, the more structural solutions these are generally used where there's high urbanization and high expected changes; so you can start to construct an idea of through your particular community, for your level of development, for your level of economic damages what might be suitable where and how to stack these to add to the resiliency.

So a good example is one of the Sandy's rebuilt by design plans for the City of Hoboken where they had the flooding shown at the left from Hurricane Sandy and then on the right hand side you see that they have different things. They've got structural measures for discharge pump, they've got a manscaped levy, they have zoning policies that's non-structural and our language, there's a green belt that provides storage -- that's a nature based type of structure. And then they've got hard infrastructure on the right hand side; so here's a nice case of an integrated approach, which really reduces the flood risk in this particular neighborhood.

And for more information on what the core is doing and other agencies, the agency developed in submitting climate change adaptation plans to the council on environmental quality and the office of management and budget and this link on the bottom brings you to the cores climate adaptation plan but if you Google CEQ climate change adaptation you will come to the location of all of the adaptation plans and you'll be able to look at them you know for your particular agency to see you know, if you're interested in HUD you can look at theirs or FEMA's or other agencies.

And then I want to point out that if you've got new infrastructure, if you're planning for new infrastructure and starting from scratch so to speak there are tools available that people use. For us in the coastal arena it's very important that we know about our sea level data, that's the zero point from which we measure. It's really important because that data is changing constantly and we want to make sure that we are measuring for today accurately and then we've estimated what the future changes in that data that zero point will be. We also have an online tool that calculates sea level rise, impacts for NOAA tide gages using NOAA data and then we have another tool which we worked with NOAA and FEMA on it's a sea level calculator for the Sandy recovery area. And we can estimate different sea level scenarios as shown in the bottom graphic. You see the curved lines; those are different scenarios and then that bluish band, that's a certain recurrence interval of flood. Again very simplified, it's not 5 million dollars worth of modeling but it's enough to give you an idea of what might you want to consider in the future for your particular location for the kinds of events that you might be experiencing; so that's for new infrastructure.

And another page that's important, this is for hydrology, which I haven't talked about much here. But there is an inner agency archive of downscaled climate model information and hydrology that's been developed that we're working with. And we have a little bit of guidance out, I'm showing you a picture of output from this archive where the top is showing changes in flow and what you see is a very widely varying observed location. If you go to the bottom it really varies a lot; that's the projected in the future from all the different point models, all those different colors in the bottom graphic are different climate models. So what we see is maybe it's not telling us that much; we might have to be looking at it in a different way. So we're starting to look now at potentially identifying places where the trends are changing and the observed or projected records. And we're looking at changes in frequency, on this particular example in the lower right hand curve the intervals on the bottom and the discharge is on the Y-axis and those little dark triangles are the observed frequency curve, and the little colored ones again are the result of all the different climate models showing that in this particular location we would be expecting the frequency curve to change, increasing on the lower end, potentially decreasing on the upper end. But it's again very site specific. This isn't going to be the same picture all the way across the country.

So for existing infrastructure though you first have to understand your vulnerability and so for the core we've developed a tool and we've assessed over 1,400 projects, our projects to assess their vulnerability and what we found is that about 7% of these have high or very high vulnerability and now we're working on more phased examinations of these and we're working to modify this tool for Army as well; so the idea that there are tools and ways out there to look at your vulnerability in a simple way and you can screen out projects that aren't vulnerable so you're not worried about them. But then really concentrate on the ones that are.

Okay so in summary we think that effective climate preparedness and resilience has a systems approach that balances the trade off, it considers long term planning, it considers differences in adaptive capacity and tailors the responses to your local community and also considers what are the performance ranges of the different risk reduction measures. Again I want to stress no silver bullet, only silver buckshot. Multiple responses are necessary. That requires an innovative and integrated approach with full portfolio measures stressing those non-structural message; one, two and four listed by Chad earlier. Tough choices are going to be made on a national basis. I think we can make them best by working together to come up with varied solutions that are tailored to our local regions; so that's my last slide.

Lynsey Johnson: Thanks so much Kate. Next I'll turn it over to Bob from frigid Chicago to talk a little bit more about green infrastructure.

Bob Newport: Thanks Lynsey and what we're going to do now is move on to talk about some practices that cities can implement to strengthen their resiliency with the focus on ways to soak in water and reduce the volumes of water that need to be managed. We've got a little bit of a preview of this from some of the things that Chad talked about. When we discussed green infrastructure there's two aspects of it that we think are important. One is what we might refer to as natural green infrastructure and that includes things like prairie, the grasslands, woodlands, wetlands and green open space. And all these types of things perform valuable functions because they do a great job of soaking in water and so what we want to do is try to protect and restore those areas. And our strategies for doing that are very similar to the strategies that Chad talked about for protecting and restoring flood plains. We can use things like conservation easements, we can use our zoning and comprehensive plans to try to protect those areas from development. We can try -- do our best to restore those areas and to steward those areas and we can work with partnerships with forest reserve

districts and park districts and local corporations to do our best to try to preserve those areas. So that's natural green infrastructure, but we also talk about what we might refer to as storm water green infrastructure and these are not natural features. But what we're talking about are constructive features that can mimic natural systems and those are things like rain gardens and bio swales, permeable pavement and green roofs.

So why do we need these storm water green infrastructure features? Well really what it comes down to is when we do development, when we create urban areas and suburban areas it increases the amount of run off. In a natural condition like what you see on the left on this slide where it's a forest or a meadow when it rains most of the water soaks into the ground or goes back up into the air through evapotranspiration and only a relatively small percent runs off. But in a developed area, an urbanized area that ratio flips around and most of the water actually runs off. And there's a common sense reason why that happens. It's all the impervious surfaces we create an urban area. Things like street and rooftops and sidewalks and driveways. These surfaces repel the water and keep it from soaking in and it creates run off and that run off has to go somewhere. So in a situation like what you see here in this aerial photo 75% of that land area is impervious surface and it all drains into sewer systems and then it gets released to local water bodies in a very short amount of time. And so there's a lot of physical effects on water bodies from the large volumes of water that gets discharged, and this is one of the areas that EPA is very interested in because in an area with combined sewers you get all that water going into the sewer system and then you have combined sewer overflows. And even in areas that have separate systems you're still sending a lot of water to the downstream water bodies, the stream or the river and there's a lot of negative effects on those water bodies from the high volumes of water and it causes degradation of those water resources. And there's also a lot of pollutants and storm water and things like nutrients and pathogens so where does that come from, the rain hit the parking lot and it runs across the parking lot. It picks up oil and grease and other substances that were on there and then it goes into the sewer system and gets discharged. So there's a combination of physical effects from large storm water volumes and chemistry type of effect from the pollutants in the storm water and those things together are bad news for water resources because what we see is the recurring pattern and the more impervious area there is the more degraded the local water bodies are.

But what we're talking about today in the topic of resilience is also related to this amounts of impervious surfaces and what we see is Chad talked a lot about over vane flooding and the need to prevent protect flood planes. But we also have flooding within urbanized areas where we have basement back ups and we have streets that flood and it's because there's just too much water and there's no place for it to go. So the challenge that we have is to try to take an urbanized area with developed condition with roads and sidewalks and people but have it function in a hydrological way the way a natural area would function. And that's where storm water green infrastructure comes in. These are practices that have the effect of increasing infiltration meaning we're soaking more water into the ground. It increases the evapotranspiration that means the trees send more water back up into the air and we harvest and we reuse storm water instead of allowing it to run off and be discharged. And all these practices together have the effect of reducing the volume of storm water run off. One of the most common examples we have of an infiltration practice as a rain garden, you see some photos here from Maplewood, Minnesota, which put rain gardens throughout their community. The concept of a rain garden is very low tech and sort of common sense. You find the lowest point in a land area, you excavate out sort of a bowl shaped area, you put soft soil and within that bowl and then you plant wetlands type plants. And then that acts like a sponge and it will soak in water into the ground. And I know that sounds like kind of a low-tech approach but we've seen some examples where it really was proven to work well.

One place where the effects of rain gardens was measured was Burnsville, Minnesota. What they had was two subdivisions that were very similar and in one area they went through and retrofitted the neighborhood with rain gardens. And the other neighborhood they left it alone and then they did monitoring of the two neighborhoods. And what they found over the course of a year there was a 90% reduction in the volume of storm water in the neighborhood that had the rain gardens as compared to the other neighborhood that didn't have the rain garden. At least at its conclusion these green infrastructure practices can really make a big difference in the amount of water that needs to be managed. So besides infiltration practices there's a whole variety of other green infrastructure practices including green roofs. This is the green roof on city hall in Chicago. It can absorb about 75% of a one-inch rainfall. This is a green roof on public housing building in Milwaukee and it's what we call an extensive green roof, meaning it's very light [Inaudible 01:11:09] are trays of about two inch depth that have a plant called sediment -- acts kind of like a sponge and soaks in water. But the trays are very light and they're very easy to install and if you need to maintenance on the roof you can lift them up. So these are options that are very viable for lots of buildings with flat roofs like big box stores and public buildings with flat roofs.

And another thing you can do is rooftop water is capture it in a cistern and reuse it. So you see an example on the left there which is Lake County, Illinois forest preserve district. They take that water off of the roof, they store it in the cistern and then they use it to irrigate the grass and plants in dry weather conditions. One of the places where we really have a lot of run off are parking lots because they're wide surfaces of impervious area and we are very fond of creating parking lot islands that have raised curbs like what you see in the top right there. And it's not so good in vertical print there. And no water really can soak into that island because it's raised up above the parking lot and so what you can do instead is create islands like the bigger picture, the lower left which is lower than the parking lot and then you have curb cuts to let water into that and then that will soak in the water off of your parking lot.

Another option for parking lots is to use permeable pavement. These are types of pavements that allow the water to go through the pavement instead of running across the surface. This is the Morden Arboretum in Mild, Illinois and they have a combination of permeable pavement and bio swells in their parking lot, which means in almost any size storm there's no run off from this parking lot whatsoever. Those are paper blocks that you see in the Morden Arboretum parking lot but there's other types of permeable pavement including permeable concrete. You see a street there on the left that's in Seattle that's constructed with permeable concrete and permeable asphalt. All those are examples of types of technologies that allow the water to soak through the pavement instead of resting on the top and running off.

So we've seen some examples where cities have retrofitted their streets with a goal of absorbing more storm water and one of the good examples is from Seattle. This is an example of the street, what it looked like before it was retrofitted and then here's the same street after it was retrofitted. I know it's kind of hard to believe it's the same street but you can see it had ribbon curbs on the side and it's crowned in middle so when it rains water runs off the street to the side and then it soaks into those big bio swells on either side. And what we found in Seattle was they had a 98% reduction in the amount of run off of that street over the course of a year because it did such a good job of soaking in the water.

Here's another example of a street retrofit. This is a commercial street in Lansing, Michigan. Here's what the street looked like before it was retrofitted. You can see it's almost completely impervious

surface so however much rainfall occurs in that area all runs off. And so what they decided to do was create planter boxes that would take water off of the sidewalk and off the street and they found that they could take in all of one inch of rain off of that entire street and soak it in with no discharge. And by doing deeper planter they could actually absorb up to four inches of rain with these planters. And a side benefit that occurred was the merchants on the street thought that the street looked a lot better after the retrofit was done. So we got a double benefit there in terms of economic revitalization of the street and the same practice at the same time was doing a great job of soaking in storm water.

One other place that we are considering for -- as a great place to consider green infrastructure is on vacant parcels and we can take an area that looks sort of blighted and rumbly and convert it to an area that looks like this and take water off the street and off the sidewalk and soak it into a rain garden and have it look like an amenity for the neighborhood. So we can again get sort of a two for one in our public investment; we can solve the storm water problem and help strengthen the neighborhood at the same time.

So we're going to wrap up by just saying that we think that city's can use a lot of their tools to implement green infrastructure they can use ordinances and incentives to try to encourage green infrastructure on private property and then the city itself can implement projects on public property to try to soak in water. Examples like what you saw in Seattle and in Lansing. And we think that green infrastructure is part of the toolbox for enhancing resiliency because it can help reduce urban heat islands in the summer, it can help sequester small amounts of carbon, it soaks in water as you can hear from Kate, gray infrastructure is relatively fixed in its capacity and has a long life. In some cases it's very costly to expand or replace gray infrastructure but if you put gray infrastructure and green infrastructure together you can enhance your resiliency and add to the effectiveness of your wet weather infrastructure.

So we're going to move on from here. Joanne is going to talk about some approaches for implementing and for financing green infrastructure. So I'll turn it back over to you Lynsey.

Lynsey Johnson: Great, thanks so much Bob. I just had -- George are we okay on connection?

George Martin: Yup. We should be good.

Lynsey Johnson: Okay fair enough. All right, so we'll turn it over to Joanne to talk a little bit more about financing.

Joanne Thorough: Okay, all right. Thanks Lynsey. Thanks everyone. I hope you're a little bit warmer than I am here in Maryland today, 18 degrees the last time I checked. Luckily you can find some of the EFCs close by you, I just want to let you know that they are located all over the country so this slide just shows where they are located, please reach out to them and I know for the HUD communities in particular you have resources through the University of Louisville EFC with Lauren Heverley so hopefully you've all utilized her and her services but we are part of a team so we're helping out.

So I am coming from University of Maryland, which is region three on that map, number three. And Lynsey you can advance. Well so we've been asked it's a good way to follow up on Bob, I'm really talking about green infrastructure and with Kate and Chad and all of these conversations. I'm really going to try to zero it in. Well all of you are wondering well how do you pay for this. You know,



where are the funds? So what I wanted to start with and I know we don't have a lot of time here. But I want to give you some little snippets of information of what other communities are doing, maybe some of you are on this webinar right now and you see on this green infrastructure financing them. What we've done we've taken 20 different approaches, 20 different communities. I know there's a lot more out there but now if you go on our website at [EFC.umd.edu](http://EFC.umd.edu) you will find this map and then you can click on that and what you will find are infographics. It's a great way to get snapshots of information so beyond this webinar today start playing with this map and look at what some of the examples are around the country, what people have done and how they financed it. So that you can see innovative ways because they're out there and some great examples and these links will take you to -- there will be different links that take you to the location to find out more. Next.

All right, so one of those infographics and this I cut and pasted the infographic on here. So my apologies if I didn't do a great job but really taking a place, which is in my region, Warrenton, Pennsylvania. Warrenton is located outside of Philly. It's in Bucks County. It's a very interesting community in that what they have done here with a population only of about 23,000 in 2012 they passed an open space referendum, which pretty much authorized 3 million dollars over 20 years to purchase and protect open space. So when Bob was talking about all the different things that could be done here is an example of a community who believes that the green infrastructure approached with the right way, protect their land from more development, looking at ways to combine growth within the community and protect those natural areas.

So one of the things that we have -- we did at EPA had asked us to really help them along because they couldn't quite make a decision. So they have this money, now what do they do with it. They talked about connecting trails; they talked about paving over some of these trails. Maybe putting in a ballpark and they weren't quite sure. So we helped prioritize and what we did with this community, we were able to do three things. First of all here they start and I really want to drive this home for the people on the call. You start with some money; it helps to really leverage that money. So looking to know you have a priority, you have a plan, you have a strategy for protecting, preserving your open space. So let's look at other ways you can leverage those resources; so what we've done is really lifted out ways that they could leverage their funding and identify and prioritize different federal, state and foundational efforts as well as private sector funding. We also took this community and really connected them to partnerships that they were out there. They just didn't know to connect with them and those partnerships included connecting them with land trusts who were really just raring to go and ready to communicate and facilitate making that decision for that community. And then the third was very interesting approach which when a community can't quite decide well what are they going to do, how are they going to protect all those options Bob gave. Now how do they make their community -- put the money to the best use. So what we did and Lynsey you can switch to the next slide.

We integrated, we're able to integrate green infrastructure into their planning and project design, site design. We worked with the University of Maryland, had a landscape design plant size, group and we had some students and we really took what they were envisioning and gave them options. We showed that green infrastructure can indeed be incorporated to some of their comprehensive plans, some of the ideals that the community wanted. So here we have a few of these options that we made in screens for the community to really review and all of a sudden they're looking at this and they're seeing options for green infrastructure saying "I want that for our community". I wasn't able to share all of it here but I encourage you to go onto our website for all of the options and the information, which was a really unique approach because communities can occasionally visualize what's happening and then they can make better decisions. Next.

So another community I want to highlight a little bit on what Kate and Chad mentioned earlier. We've got a community and Talbot County, Maryland. It's Maryland's eastern shore. It has a very small population so if anyone on this phone says -- on this webinar says "Well they can't do it; they're just too small of a community". Well a place of a population of 650 can do this; I think there's opportunities for everyone. And this community is located on the Tred Avon River and when you're talking about climate change this is the community that is so impacted. I mean it is historic, it's 2011 I believe it was named by the yachting magazine as one of the world's best water front communities. And they are feeling the impact of climate change. So they brought us in, the environmental finance center and they spoke to us, showed us around where they were having impact and what could they possibly do and how much is this going to cost? Next slide.

And so we started collecting pictures. We started talking to the community. One thing I want to encourage everyone to do when you start looking at what you could do with the impact of climate change, resiliency, just simple storm water solutions whether you're going to choose green infrastructure or gray infrastructure you need to involve the community; this is very important. I think Chad mentioned about education and I can't tell you enough how much the community actually does have opinions. We came into town hall expecting no one to be there, not even advertising the meeting and it was almost standing room only as people wanted to share their information and the problems they were having. So these pictures show an example of what was taking place in that community. Next.

So what we did is we said, "Okay everybody wants a voice in this community"; in order to really put -- to understand what improvements can be made. For example, both green and gray things that Kate mentioned. Let's take what the engineering has developed for the community but then let's take that and develop it further and have the community tell us exactly where the problems were. So this is an exercise that we did that people were very specific on flooding issues and drainage problems and infrastructure that was failing, that wasn't working. So we were then able to say, "Okay here are the problem spots" and compare it with the information that the engineering community had given us. Next.

What we also did was make sure that you're not afraid of the word financing. Some how communities when you go into help a community they say "Well don't mention the word financing". Well it's not a bad word. It needs to be talked about. There has to be reasons and ways to pay for this and people have to understand if they are going to contribute or if it's going to be general fund money, where is it going? What is it going to be spent on? So we worked with some partners to really put on different workshops and educational opportunities, talking about bio swells and French drain workshops and what we also did is take rain barrels, which really weren't in town and it's a very artistic community. They decorated them, they auctioned them off and they located them on a nice walking trail around town. Really the community got fully engaged and involved. Next.

So what happened was once we were able to combine the financing, a comprehensive look of what they needed and the options. We looked at a few -- a range of spending options for programs that they could develop and one was basically do what they were doing, which is take whatever they can get and very limited grant funds. You know maintain what they have, not a great maintenance program, not much in a way of capital improvements or start to really look long term and invest. This was talked about on this webinar. Really start long term planning beyond maybe your permit or start looking at going above and beyond. So where we found most appropriate, loved the name

we called this Goldilocks Program that was an option of where they should get the most bang for their buck. Next.

So what we gave them was a few options. Sometimes it doesn't always work to tell them "This is how much it's going to cost, this is exactly what you need". But give them a range so they're a little more comfortable with making choices for themselves. And in the end what was beautiful about this community they chose an option somewhere in the middle. If you look at the five year costs they were one of the first communities to implement a fund that covers storm water looking long term for climate change, implications of climate change and that fund they called the shoreline protection fund brings in about 100,000 a year so they've pretty much chose option two. And I've been able to leverage that with quite a few grants. Next.

All right, just briefly I want to mention a community that is obviously not on the coast for many of you who are on this webinar who were not located along the coast. You're still seeing impacts of climate change and it could be in terms of this community, College Park where the University of Maryland is located. We went into that community and we asked about climate change and they said, "No but we have seen a lot of flooding lately. We have seen it so much more often and we can't understand it". But they didn't understand that anything was related to climate change. So we started doing, again what we did in Oxford and really talking to the community and looking for options of infrastructure, green infrastructure investments and looking at their flood plain maps and what was planned on their capital improvement program. So this community is a great example of you know, sometimes you're putting in projects they may not be best located in the places that are chosen. Maybe they are best for reducing pollution and getting credit for your TMDL. But they may not be what the community values; so taking that input, looking for best locations for green infrastructure. This map shows you exactly where the community was able to tell us where they thought they would value green infrastructure and you see all the green dots on that map which completely differed from where the city was planning to put their green infrastructure. So we were best able to work with the city and try to identify better locations for green infrastructure that the community would maintain in value. Next.

And I know we're running out of time so I'm going to move forward. Federalsburg is a community here. It's in Maryland, on the eastern shore and sometimes it's not just about financing. Sometimes a community like Federalsburg really didn't understand what their infrastructure looked like. They didn't know where infrastructure was located, what condition it was. So we were able to work with a team of University of Maryland engineering students to go in and really help the engineer who didn't have the capacity to do this and go in every week for six months and map the entire infrastructure and this led to a storm water management plan, which was the step that was needed before any type of infrastructure investment be it green or gray were made because they just didn't understand what was happening and what beautiful thing came out of this particular project was that they said, "You know what where we were going to put all the gray infrastructure and green was absolutely the wrong location". Once we understood our infrastructure we were able to develop a comprehensive capital improvement plan that really went out beyond five years to 10 years and start planning for it. Now we know how much it's going to cost and we can better utilize the funds we have. Next.

So quickly I want to mention what I believe is a good example of not just understanding gray and green infrastructure and financing but looking to strong leadership as a community right by -- well it's in Lake County, it's Lake Erie -- located by Lake Erie. Lake Erie College is actually located here in Painesville, Ohio and they had a new leadership. They had a city manager who came in and

didn't know that much about storm water but was interested and they started to hear complaints and the community said, "You know I've got flooding on my property", we've got all these infrastructure problems, cave ins and things started changing after a storm in July 2006 where flooding was just constant. So the city was paying a fee. They were collecting -- they were collecting a fee from their residents but it just wasn't well managed. A community needs to understand where that money is being spent and to know there are improvements being made. So there was no long-term vision at all. There was no outreach or education and quite honestly the team -- the existing team who managed storm water and green infrastructure and any part of their program didn't understand what their responsibilities were because they really focused on the wastewater side. Next.

So what happened was that they were able to -- this will just show you examples of where they're capital improvements were and the problems that we found a little tracking and reporting didn't know their infrastructure condition very low level of service provided to the community. Next.

And so what they were able to show was that they were paying something into the county. The county was giving them very basic level of service. What they ended up doing is getting just your basic -- very low-level public education involvement, some financial services for collecting the fee. But they had an option. Next Lynsey.

They had an option to scale up their service with the county and have this relationship with the county that they were, for just a little bit more money, they were able to get services from the county covered for all of their six minimum control measures on their permit. And what they were able to do is get some of that money back that that they were paying in to put towards capital investments for the future on their infrastructure. So next Lynsey.

And I'm being very mindful of the time. So what happened was if you see this list we were able to look at all the proposed projects with just scaling up on -- just a little bit on the amount of money they were paying. All of these are projects that were listed as the most important to control some of their flooding. Some are green infrastructure, some are gray but you see the design and construction and the cost is all set up for the next few years. And this is only because they had strong leadership and the community wanted to see improvement, but they were starting to be able to understand what things cost and how to spread the cost out and prioritize projects. Next.

So what I -- and unfortunately I know we're limited on time but this is a great example. I encourage all of you to go to the website and you'll see what they were able to do is set up not just capital improvements but a drainage assistance program, a green infrastructure program, a backflow preventer program. They completely reinvented their engineering department. They changed the level of service. They have things planned. They are responsible for storm water and with all the implications of climate change they're ready and they're starting to plan and move forward. So I believe they're model to look at and relationship that happens between the municipality and the county and I would love to see more of this around the country. Next.

And just my last slide here, I just want to say there is other things' happening. For example, the Naragansic Bay (ph) and the city of Annapolis, both areas very concerned with coastal flooding infrastructure needs. And there are ways; this is the project-taking place right now where looking at green infrastructure, sustainability partnering two communities together. One deals with obviously Chesapeake Bay and flooding issues but another dealing with very similar issues. There are lessons to be learned from community sharing information and data even though there is distance apart and

that mentoring and relationship I'm hoping to see some great things in the next year out of this type of relationship and see it more often. And that's it and I know I've gone over, but I know we started late, so Lynsey I'm going to turn it back to you.

Lynsey Johnson: Thank you so much Joanne, and you're right we started late so we were able to give you guys a couple more minutes and we thank everyone for like again, bearing with us through the technical difficulties and starting a little later today. I want to make sure that everyone has the presenter contact information; the presenters have been gracious enough to take questions via email so if you have questions you can email them directly. But I do -- it's okay with everyone in terms of presenters I wanted to just open it up really quick to the question and answer chat function on the WebEx software program. So if you have any questions please feel free to chat it in or raise your hand and George can un-mute you. But once again I want to reiterate the fact that this webinar will be posted and archived to the NDRC website, webinar website on the HUD exchange. So the slides that were presented today, the transcript as well as the recording will all be posted there for you to go back and look at because I think this is just -- important webinar in that it's so content rich to go back and really revisit and look at these case studies, these best practices and these tools because ultimately flood disasters are one of the most costly events that we see yearly as Chad pointed out. And it's definitely something that needs to be addressed nationwide. So with that I'm not seeing any questions. So once again please feel free to contact the presenters with specific questions and I want to thank the presenters again for taking time out of their schedules to put together the presentations and then also share the afternoon with us today. Again thank you all for joining us and we look forward to you joining our next webinar coming up in the next few weeks. Thank you.