

U.S. CORPS OF ENGINEERS

**Moderator: Ellen Berggren
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Tyson Vaughan: Okay, hello everyone. Thank you for joining us. My name is Tyson Vaughan, I'm the facilitator today. Let's go ahead and get started.

First let me say if anyone is having difficulties seeing the presentation title slide let me know in the chat. You can also speak up by pressing Star 6 if you need to. I can see it so I assume others can but if you can't do let me know.

Welcome to this month's Silver Jackets webinar, Integrating Nature-Based Solutions into Natural Hazard Mitigation Plans, on the Ashland, Oregon Pilot Project. This session's presentation is being recorded, although not in the Q&A portion, and we'll post it on the Silver Jackets Web site along with the previous webinars.

So a few small items before we get going. Probably a lot of you are regulars and you are used to Norb Schwartz facilitating these webinars. Well he's done a wonderful job for a number of years; Norb is now on the verge of retiring, sadly for us but good for him, so I'm going to be filling in for him. And he is on the webinar today so he can save my bacon in case something goes awry. I appreciate that, Norb; congratulations, and we wish you the best.

So everyone on the call, you're encouraged to use the chat box throughout the presentation to submit questions. You'll see the chat button in the upper right of your screen and then the actual chat box is in the lower right. We'll address the questions after the presentation.

And when you're using the chat box there's a little drop-down menu that's right above the text box area where you can select who you want to address it to. You can address it to everyone so that everyone can see your question or if for some reason if you just want to direct it to me, the facilitator, you can do that.

I have muted all the lines. If you want to ask a question at the end you will need to press Star 6 to unmute yourself.

Want to also mention that we have been approved for one hour of continuing education credit for certified floodplain managers from the Association of State Floodplain Managers. So if you qualify and you attend the entire webinar just send an email to me after the session and let me know. I'll put my email address in the chat box so you can see it easily and we'll put it up on the screen as well, at the end.

Now Ellen Berggren, the Deputy National Silver Jackets Program Manager, will introduce today's topic and the presenters. So, Ellen, I'll turn it over to you now.

Ellen Berggren: Hello, can you hear me okay?

Tyson Vaughan: I got you.

Ellen Berggren: All right, thank you. Good afternoon from Alexandria, Virginia, everybody, and welcome to December's Silver Jackets webinar.

The Federal Emergency Management Agency and the Environmental Protection Agency have partnered on several pilot project efforts to integrate green infrastructure and low-impact development measures into natural hazard mitigation plans as a natural hazard risk reduction strategy. Today's Silver Jackets webinar presentation will describe the pilot project effort associated with development of the city of Ashland, Oregon's natural hazard mitigation plan.

The Oregon Partnership for Disaster Resilience at the University of Oregon used its energy, expertise and innovation to work with the community and other partners to update the existing plan. The presentation will discuss the EPA/FEMA collaboration and the steps involved and lessons learned from the City of Ashland Pilot Project.

Our presenters today are Krista Mendelman from the Environmental Protection Agency or EPA, and Josh Bruce from the Oregon Partnership for Disaster Resilience at the University of Oregon.

Krista Mendelman has worked as an Environmental Scientist with EPA's Region 10 for 25 years. Region 10 serves the states of Alaska, Idaho, Oregon and Washington and more than 270 native tribes. She grew up in Annapolis, Maryland on blue crabs and got her Bachelor of Science in Estuarine and Environmental Science from the College of William & Mary in Virginia.

She has completed postgraduate work at the University of Washington. She has worked on a variety of programs at EPA mostly related to watershed protection, non-point source and green infrastructure. She'll be introducing

today's topic describing the EPA/FEMA collaboration to include nature-based mitigation strategies into natural hazard mitigation plans.

Josh Bruce will follow Krista. Josh has a professional background in land use planning and has been a leader in community resilience and local sustainability conversations for over 15 years. He is a faculty member in the University of Oregon's Institute for Policy Research and Engagement and directs the Oregon Partnership for Disaster Resilience. He focuses his applied research on community resilience and risk reduction objectives throughout Oregon and the Pacific Northwest.

Prior to joining the university Josh worked for both public and private sector employers focused on land use planning and community development projects. He currently serves on the Oregon American Planning Association's Legislative and Policy Affairs Committee. He'll be providing the details about the city of Ashland Natural Hazard Mitigation Plan Pilot Project.

So Krista and Josh, thank you so much for being here today and sharing this very interesting pilot project with us. And Krista I'll turn it over to you.

Krista Mendelman: Thank you, Ellen, thank you, Tyson. Can you hear me?

Ellen Berggren: Just fine.

Tyson Vaughan: Yes.

Krista Mendelman: Great okay thank you so much for this opportunity to talk about nature-based solutions to hazard mitigation planning from this dark and cloudy December day here in Seattle.

So I want to acknowledge that this effort in Ashland would not have been possible without Josh Bruce, who's going to speak next. His expert knowledge and team of students just really did a great job navigating the challenges of bringing folks out of their silos which is really important for this work to create something new and really the compounding challenges that everyone is so busy kind of doing their own work.

I also want to acknowledge Josh's work in creating this PowerPoint as one of the final products from this grant. This project would also not have been possible without Brett Holt from FEMA Region 10 and Lisa Hair and Laura Bachle from EPA headquarters.

So I'm going to give a short overview addressing the first bullet on this slide and I'm going to talk about EPA and FEMA's goals. Then Josh will take over with a description of the Ashland Pilot Project, the resulting recommendations for Ashland's natural hazard mitigation plan and a look at the lessons learned from this pilot project.

In the spring of 2016, EPA Region 10 and FEMA Region 10 were awarded funding by EPA headquarters for a joint proposal to complete a pilot project that would develop recommendations to integrate green infrastructure and low-impact development practices into the natural hazard mitigation plan for the city of Ashland, Oregon.

We were looking to hit the sweet spot between where FEMA and EPA goals and objectives overlap. FEMA is increasingly looking at climate adaptation strategies and shifting the planning mindset from a post-disaster mindset to a pre-disaster mindset. EPA's mandate under the Clean Water Act is to protect and restore the chemical, physical and biological integrity of the nation's water -- and green infrastructure and low-impact development practices that

are at that sweet spot where FEMA and EPA's goals overlap. I'm going to talk a little bit about these concepts just a little bit more in the coming slides.

So first off, when we refer to green infrastructure we mean the network of environmentally significant natural and semi-natural areas. Some examples of green infrastructure techniques are wetland protection and restoration, floodplain protection and restoration and increasing infiltration through forest restoration.

When we use the term low-impact development we are referring to techniques that mimic predevelopment ecological systems including the hydrology and soil composition, et cetera. Green, low-impact development practices include bioswales, infiltration next to impervious areas, pervious pavement, rain gardens, green roofs and more.

All of these practices can be applied at the site, neighborhood, or watershed or regional scale depending on the size of the practice. At EPA we've looked at these techniques to address our water quality issue.

From the FEMA side, disasters occur when natural hazards meet vulnerable systems. Natural hazard mitigation plans are developed, adopted and implemented by communities, states, tribes and local governments to mitigate disasters. So the natural hazard mitigation plans contain a risk assessment, a mitigation strategy with action items, and an implementation and monitoring strategy.

FEMA requires that natural hazard mitigation plans be developed and updated every five years if a local government state or tribe wants to apply for FEMA mitigation funds. Often the action items identified to address hazards are the more traditional hardening techniques.

Through this pilot we were looking to demonstrate how to move from a more traditional approach to hazard mitigation planning, that involves primarily hazard managers identifying the action item, to an approach that involves getting input from a broader group of people, including water quality and natural resource managers, to help identify green infrastructure and low-impact development practices that could be added to the hazard mitigation toolbox.

One of the many motivating factors in bringing new groups of folks to the hazard mitigation planning table is that when we add green infrastructure and low-impact development to the hazard mitigation toolbox we gain hazard mitigation benefits including reduced flooding, lessening of the impact of drought, reduced risk of fire and landslides, but we also get many social, water quality and other environmental co-benefits.

So this slide broadly demonstrates the co-benefits of some green infrastructure and low-impact development practices across various hazards as well as water quality and community benefit. If you see a full circle, that indicates strong positive overlap. Half circle indicates partial overlap, and no circle indicates no or limited overlap.

Furthermore, the economic benefits of mitigation are really significant. According to a 2017 updated study by the National Institute of Building Science, federally funded mitigation grants provided by FEMA, the US and Economic Development Administration and the US Department of Housing and Urban Development or HUD resulted in a \$6 savings for every dollar spent over a 23-year period.

This new data from this updated study increases the average cost/benefit ratio from \$4 to \$1, up to \$6 for every \$1 spent. So the more techniques that we can add to the mitigation toolbox the better we are going to be.

We also have evidence from case studies across the country that utilizing economic analysis for green infrastructure and low-impact development can address public concerns and gain stakeholder support and can cost less than grey infrastructure alone. It can result in those multiple benefits that I was talking about before, or co-benefits, and the approaches can successfully be integrated into capital improvement programs.

The goals of this Ashland project, in summary, were to expand the range of tools used to mitigate flood risks; institutionalize green infrastructure and low-impact development into flood risk management planning; enable those FEMA funds, those mitigation funds, to be directed to a green infrastructure and low-impact development projects; and promote the understanding of those co-benefits of green infrastructure and low-impact development in this hazard planning world, including improved water quality, hydrology, climate mitigation, air quality and quality of life.

The Ashland Project was one of four pilot projects completed by EPA and FEMA. There are three more underway in EPA Region 4 with the state of Kentucky, EPA Region 7 in the lower Meramec River region in Missouri and Region 6 with the city of Denton in Texas.

So now I'm going to turn it over to Josh to talk about the pilot project specifically in Ashland. So Josh go ahead and take over the controls when you're ready.

Josh Bruce: Great, can everybody hear me okay?

Tyson Vaughan: Yes we can.

Josh Bruce: And, Tyson, are you seeing the right slide there?

Tyson Vaughan: I sure am.

Josh Bruce: Excellent, sweet. Well first off, thanks to everybody for tuning in to learn more about this project. Just a huge shout-out to Krista Mendelman and Brett Holt for actually pulling the funding and the project together and having the foresight to give us a shout and invite us to participate in the project. It was certainly fun to do. And thanks to Ellen and Silver Jackets for having us on today.

So what I want to do is, like the overview slide said, give a little bit of background on the pilot project itself, talk about some of the specific findings from the project, and then end with the lessons that we learned, before we open it up for question and answer.

First just a real brief background on who we are and how we work in the state of Oregon. I will note that when we did this project we had a different name; we were called the Community Service Center. Since then here at the U of O the Planning Public Policy and Management Department has become a school and as a result the Community Service Center has a new name; we're called the Institute for Policy Research and Engagement now. But if you do happen to look at the reports, those were done under our previous name. Just know we're still the same type of program doing the same type of thing.

This graphic in front of you now illustrates how we work. So really our dual mission is to link the energy, expertise and innovation of the U of O with

planning and public policy needs throughout the state of Oregon, and we do that through a service learning model where we engage students in real funded projects, applied research projects, throughout the state. We're looking to link government and communities together and professional practice with, again, the research and activities that are happening here at the U of O.

The Institute for Policy Research and Engagement has a pretty varied history of working on a wide variety of projects throughout the state of Oregon. If there's a planning or a policy topic that this state's tackled, really in the last 40 years, we've probably done a project on it.

Currently our portfolio ranges from everything from agile strategy development and social planning to food systems and housing. The linkages to this project in particular bring our expertise in working on natural resource planning and management projects throughout the state with our natural hazards and community resilience focus, which I've managed for the last ten years or so.

We have two distinct delivery models, one is a campus-based delivery model where we're engaging mostly graduate students but also increasingly undergraduate students in, again, sponsored project work that has real budgets, real deliverables. We have a couple different classes including managing the practicum for our master's candidates in community and regional planning, and we've just launched in the last few years an undergraduate program called Real World Eugene that focuses on hyper-local planning and policy projects here in the Eugene-Springfield area.

We are a 12-month-a-year kind of shop so when we're not engaging students through our classes we are hiring either interns or graduate employees to work on our projects. And you can see there that our campus-based projects range

anywhere from, you know, small \$5000 feasibility studies or things like that to these multi-year multi-\$100,000 federally supported projects.

I also just want to mention that we have a field-based delivery model as well that's a partnership with AmeriCorps. We're celebrating our twenty-fifth year of delivering our Resource Assistance to Rural Environments Program, and that's where we're placing between 25 and 35 AmeriCorps-supported service learning folks out in rural Oregon, focused on similar topics that I mentioned before, anything from housing and main street economic development projects to these more environmentally-based projects.

The placements are in communities for 11 months out of the year and provide the communities with about 1700 hours of service. The communities come up with a cash match of about \$22,000 that, again, we're matching through AmeriCorps. So for our rural communities it's a pretty good deal.

Before leaving this slide I'll just call out the students that you're seeing in the bottom left; those were the students that worked specifically on this Ashland pilot, and I just want to acknowledge them, because without their efforts certainly the project wouldn't have been completed. Ethan Lockwood is a second year, a master's student who managed this student team and then we had Michael Johnduff, Emily Fenster, Emily Hajarizadeh -- she's going to kill me for butchering her name -- and then Kristen Sabo all worked on the project.

So just to orient you a little bit, the city of Ashland is located in the southwest quadrant of the state of Oregon. It's in the foothills of the Siskiyou and Cascade Mountains, at the southern end of the Rogue Valley. Population is about 21,000 and their economy is largely driven by arts, tourism and outdoor recreation.

The city of Ashland hosts the Oregon Shakespeare Festival. It's just a gorgeous place to visit in the wintertime. There's a ski resort 20 minutes up the road, one of the first major communities folks come to if they're driving from California into Oregon. So a lot of people like to stop there and get out and enjoy the outdoors. And then it's also really the Mecca for southern Oregon's outdoor recreation experiences, everything from river rafting on the Rogue to fly fishing to the gateway to Crater Lake National Park.

In terms of project partners, I just want to pause here too and emphasize that, like Krista said, one of the key goals of this project was to try and engage a wider set of project stakeholders than we normally engage through a traditional natural hazard mitigation planning process. So certainly we have our federal partners and our primary funders with Federal Emergency Management Agency and the Environmental Protection Agency, but then we sought to assemble a pretty diverse group of professionals from the city of Ashland -- everything from, you know, public works and water resources to planning GIS and their public works-streets folks.

We also engaged a pretty diverse group of technical advisors at the regional and state level. So we had representation from our regional solutions team out of the governor's office from Department of Environmental Quality. We partnered directly with the Oregon Department of Geology and Mineral Industries, both in serving as advisors to the project but also in providing direct services through GIS and other analysis that we utilized in our assessment.

We also engaged heavily with the Oregon Office of Emergency Management. They house our natural hazard mitigation planning activities and funnel funds. And it's important to note that part of the appeal of working with the city of

Ashland was that they were in the process of updating their natural hazards mitigation plan at the time we were doing this project.

So, connection with our State Hazard Mitigation Officer Andy Lane and Joseph Murray, who's the Mitigation Planner for the state of Oregon, was certainly critical. And then you can see other folks that we engaged. And like I said the student team here at the University of Oregon worked on the project.

Also want to just give little bit of background for why Ashland, at least in our mind, was such a great opportunity. Ashland's got a really solid history of leadership in green infrastructure and low-impact development approaches. Once we dove into the project we discovered over 40 low-impact development stormwater project that had been completed by 2010.

They already had multiple action items in their natural hazard mitigation plan that had a green infrastructure, low-impact development connection, and I'll talk about those a little bit more later in the presentation. But they'd also done pretty extensive community education and evaluation of land use activities that are in high-risk areas.

As I mentioned, Ashland is at the southern end of the valley there and there's quite a bit of topography that you'll see hopefully in a slide or two in a minute. And so understanding the relationship between the land use pattern in Ashland and areas of risk was certainly important, and the city had already done a significant amount of work in that regard.

Briefly, the city's natural hazard mitigation plan lists quite a number of natural hazards that the city is at risk to. We chose to, just for time and ability to kind of focus in, we chose three, really three and a half hazards to focus on, and the first one was flooding.

To give you a sense of just where that risk is, Ashland's got a pretty high probability of flooding. The downtown core has been impacted historically several times by pretty catastrophic flash flood events. But overall, and you can see the red there, I mean when you kind of zoom out, the city's vulnerability to flood risk is relatively moderate.

Some of the ways we were trying to link green infrastructure to the flood risk specifically, and Krista touched on some of these, was through everything from wetland restoration to green roof technology, blue roofs, bioswales, other things like that.

The next hazard that we focused on is wildfire. The city backs on to a mix of state and federal forest lands as well as pretty significant tracts of forested lands in the residential and city-owned portion of the city. The probability of wildfire in Ashland is very high, and their vulnerability is also high. So as you can see there, they have 1400 homes-plus, in and around Ashland that are within their wildland-urban interface boundary.

I'll also say, with respect to wildfire specifically, this region of the state has done some of the more advanced wildfire mitigation planning throughout the valley and Ashland has certainly historically been a tremendous partner in those efforts.

In terms of linking wildfire hazard to green infrastructure low-impact development, we're really thinking about pre-event risk reduction, thinking about native plantings but also, you know, spacing and trimming of trees and shrubs to create that defensible space opportunities, use of different vegetation types and thinking about the connection between irrigated areas and ability to enhance or maintain fire breaks.

The last hazard we chose to focus on was landslide, and we kind of threw earthquake in there, but really the focus of this effort was on the city's landslide risk. As I mentioned, you know, the city does back on to some pretty steep slopes and so the probability of landslides in Ashland is high, and their vulnerability in certain parts of the city is also high. For earthquake we looked at our probability of medium for the city and that's primarily driven by a Cascadia subduction zone event.

Some of the green infrastructure low-impact development techniques that we were looking to link with landslide really focus on slope stabilization and the use of vegetation on steep slopes to mitigate landslide hazard. And one of the things, again I'll talk about this a little bit later on too when I get to lessons learned, one of the challenges of this project was in thinking about ways to achieve co-benefits in situations where one green infrastructure or low-impact development strategy may solve one hazard problem but may actually exacerbate another one.

And so for this landslide cloud I've got the note down there that there are potential conflicts between strategies that mitigate wildfire and strategies that could mitigate landslides, particularly when we're looking at those steep slope areas. So that was one of the things that we had to grapple with and get advice from our stakeholder committee members to try and address.

Overall, just to get a refresher on our goals and to get into a little bit of how we approached scope in the project, our overall goal was to integrate these green infrastructure low-impact development strategies into the natural hazard mitigation plan action item strategy to achieve these co-benefits.

So our approach to getting there was, first up, to conduct an ordinance review just to understand from a policy framework standpoint what types of strategies the city was already employing. The next step was to conduct an ecosystem service evaluation to understand what ecosystem services the city has and how those could be leveraged.

The third step was to compile some of that into a GIS assessment. And again I have to shout-out the Department of Geology and Mineral Industries and Jed Roberts for the work in helping us compile that information set. And then finally the last step was to take all of that evaluation and assessment information and develop an updated set of natural hazard mitigation plan actions that could land in their mitigation plan.

So I'll go through just a very brief summary of what those look like, starting with the municipal code. Our code review approach and the content analysis that the students did was really trying to identify how nature-based solutions were already incorporated in the regulatory framework, and where there were gaps we used those to identify potential strategies. And we primarily focused on Ashland's municipal code for this piece.

I'll point out that, like I said at the outset, Ashland's already done quite a bit of work in this area and so in some ways one of our challenges was looking for those gaps, because as this slide illustrates, the city has quite a bit of code language or had quite a bit of code language already in place that incorporated green design standards, street runoff stormwater management, use of vegetation and other strategies to achieve in primarily environmental benefits.

And so that just gives you a sense of -- in a brief overview -- a sense of how we conducted that ordinance review. We were looking for specific standards

in specific sections and we essentially compiled those so we could try and identify gaps.

The next piece again was to evaluate ecosystem services. We utilized the Millennium Ecosystem Assessment framework to do that. We looked at seven specific ecosystem services and evaluated those for their applicability in the city of Ashland: parks and open space, preservation, wildfire resilience, steep slope stability, water conveyance, stormwater filtration, sediment retention and floodwater storage.

Again in the interest of time I'm just going to give you some real brief examples of what several of those look like in terms of our assessment. So for water conveyance part of our exercise was to define what that service provided, where the natural hazard mitigation benefits lies, so in this case reduction of flood risk impacts in urban areas and increasing infiltration rates, and then to drive that down into how it applied on the ground.

The third bullet there illustrates how Ashland streams have experienced some degree of channelization as a consequence of clean-out and flood control measures. That was a finding where we're looking to existing work that the city of Ashland had done to describe this ecosystem service.

Another example was stormwater infiltration, again the definition but then really trying to drive it back to the natural hazard mitigation benefit, so thinking about groundwater, recharge and all that can certainly help the city reduce long-term resistance to drought. And then also thinking about slowing down water and how that can be a flood risk reduction strategy and approach.

Certainly, and I'll talk about this a little bit more in a minute, the connection with Ashland is that their urbanization and their land use patterns have

definitely increased the percentage of impervious, impermeable surfaces. And so particularly in those parts of the city that have significant steep slopes there's a bit of tension between this ecosystem service and the benefits to both water quality and hazard mitigation that they're getting out of it.

I think the last one, just as an example I'll touch on, was sediment retention, and we're really looking at reduced risk of flooding from receding streams as being the primary mitigation benefit here -- the ability to balance and slow channel erosion. And in the case of Ashland it's really the developed areas along the corridors and stream channels that were opportunity areas for these types of projects.

For all of these, if you want to take a look at the details on all seven of the ecosystem services categories that we looked at, go ahead and take a look at the reports which I believe are both online. But in terms of evaluation we used a similar method as Krista showed in the beginning in terms of trying to understand whether overlaps include benefits of these types of services. So this is just an example of the types of tables that we developed to present to the locals and complete our assessment.

Finally I'll give you an example of just one of the summary sheets that we developed for each of the ecosystem services to both illustrate, again, what the service benefits are, what the hazard mitigation benefits are, what the water quality benefits are. Some of the key takeaways from the city of Ashland and the specific natural hazard mitigation plan actions that we then proposed to our steering committee. And for each of the seven ecosystems we've developed one of these one-pagers to try and summarize and compile all the information in one spot.

So briefly again, working with Department of Geology and Mineral Industries on the GIS assessment, really we were looking to identify what the development patterns were, so looking at the nexus between impervious surface and floodplain in this case, where DOGAMI could provide us with updated and more in-depth hundred year floodplain information. So rather than just looking at a static sort of line on a map, actually getting some depth grade information to inform our assessments.

And then finally the team utilized the Oregon Explorer Wetland Restoration tool to identify areas that have, you know, high potential for wetland restoration. So our GIS assessment obviously goes into quite a bit more detail that we don't have time to go into today, but that just gives you a sense of how we're trying to overlap spatial analysis and spatial data to inform where our water quality projects in flood mitigation could occur.

Switching gears to the real meat of the project, which was developing action items, I'll give a brief summary of what that process looked like and what we came up with. We wanted to start with the existing natural hazard mitigation plan, so the team did a content analysis looking for action items that already have a green infrastructure low-impact development overlap.

If I didn't clarify before, the city had an existing natural hazard mitigation plan that was in the process of being updated when we did this project, so we had existing policy to go by. Some of the examples that were already existing are relocation of their water treatment plant that wasn't as resilient to landslide, projects specifically focused on wildfire and forest resiliency, and the Dash and Firewise Program looking at vegetation management and education. These are some examples of the actions that were already existing.

In terms of the recommendations that came out of our assessment, one was around floodwater storage. What you're seeing is an example of an existing floodwater storage project that they had completed in the city. We identified several locations where there were opportunities for additional floodwater storage.

The interesting side note here, and I think I'll cover this later when we get to the lessons learned, is that most of the benefits of these floodwater storage projects were downstream of the city and so we identified that as a particular challenge because of how the natural hazard mitigation planning structure is set up.

So if you're a jurisdiction downstream from Ashland, and Ashland does this stormwater, this floodwater storage project, you receive the benefit, but in terms of the funding to complete the projects or how risks are identified, because we don't have a streamlined way to think about risk reduction at a regional scale, I mean between local jurisdictions, that presented kind of an interesting hedge factor for us where, again, benefits are construed not by the jurisdiction that's installing the risk reduction strategy but by another jurisdiction.

For our analysis steps for this first recommendation, again we at first identified impervious surfaces, compared that with the grids, identified restoration potential areas, and then conducted project site analysis to determine areas within the city that had high potential for these projects.

Our second recommendation really centered around green streets and thinking about how the city could lead implementation of green street programs in areas that had this significant increase in impervious surfaces. So for this recommendation, what informed it was essentially looking at sub-drainages

within the city, identifying areas that had over 8% impervious surface and then really driving our policy strategies toward reduction over time of those impervious surfaces through these sort of street-greening programs.

And then the last one we looked at was low-impact development retrofits primarily on private land, using a similar methodology identifying areas that have higher areas of impervious surface on private land and trying to develop programs that could de-pave or reduce that impervious surface.

The city has successful other incentive programs for private landowners already that we're seeking to benefit from and in this case apply those incentive programs to private landowner conversion of impervious surfaces.

To sort of rate these, I don't know if folks on the phone are familiar with the Federal Emergency Management Agency's STAPLE-E criteria, but because we are working with mitigation plans we selected that as our sort of review criteria. And we really, again, because of time and just our ability to engage with the steering committee, summarize that a little bit to focus specifically on technical aspects.

So: is the project feasible or achievable, the administrative aspects, does the city have the staff funding or capabilities to pull it off, is it politically acceptable to the city, and then is it economic -- does it meet that cost/benefit threshold? Other components, the social, legal and environmental aspects of STAPLE-E, we chose not to focus on. You can see we scored everything with our workshop participants and came up with composite scores for each of these three recommendations.

Ultimately what the city landed on was selecting two recommendations to put into the natural hazard mitigation plan; one was the floodwater storage, and

the other was the city-led green infrastructure project. The committee felt that the private landowner option was going to be a challenge both administratively and I think economically to pursue. So these were the two that they had moved forward.

And what I can tell you is that since the project completed, the city of Ashland did adopt their mitigation plan, including both of these recommendations. And in that county, the overarching umbrella county natural hazard mitigation plan, the full report, local recommendations report for the city of Ashland, was included and adopted at the county level.

So finally let me just talk briefly about lessons learned. I want to leave a little bit of time for Q&A so I'm going to buzz through these relatively quickly. So what worked really well? The expanded stakeholder participation worked -- I think exceeded my expectations.

For example, our relationship with Department of Environmental Quality and engaging DEQ staff directly in helping us think through opportunities for both water quality and hazard mitigation actions was tremendous. There were a number of financing structures that were recommended that Ashland I don't think had considered in this context before, so that's just one example of how expanded stakeholder participation really benefitted the project.

I've already mentioned a couple times our collaboration with Department of Geology and Mineral Industries which was a really good way for us to get some technical outputs that the students couldn't do but at the same time gave them exposure to working with other disciplines.

The other sidebar here that where we really benefited from our relationship with Department of Geology and Mineral Industries is that DOGAMI leads

the Oregon risk map and risk mapping project work in our state. And so we were able to leverage this project and actually expand its exposure within the region through FEMA's risk map program because they were meeting with Jackson County stakeholders at a similar time that this project was going on.

And then finally the increased potential for funding options, whether those be grant programs like I mentioned before through DEQ but also in thinking about, if I'm an emergency manager, how do I get out of my hazard mitigation or Federal Emergency Management Agency grant program box and actually think about applying or using EPA funds, state water resource funds, or even local maybe watershed enhancement board funding opportunities to achieve risk reduction benefits. I think that was one of the key outcomes in terms of what worked.

I'm not going to go through all of these. What we tried to compile in our final report to FEMA and EPA was a set of lessons learned, and we summarized those into specific categories. So for stakeholder engagement, for example, we have a number of participation and language lessons learned that we compiled.

One that I'll just point out that really stuck with me is that the challenge of integrating different discipline languages to achieve multi-objective outcomes is limited because emergency managers have their own set of acronyms and language, whereas, you know, water quality specialists, they got their whole alphabet soup to deal with. And because there isn't experience or exposure to those, we felt really challenged to engage the audiences without significant background.

So we ran into this problem of sometimes the level of information we were providing was really basic for some people in the audience but advanced for

others. And so some of our stakeholders felt that that challenged their ability to commit and participate in the process.

From a process standpoint some of the issues that we identified were just the timing of the GIS outputs, not enough focus on community benefits, not having a clear champion. We had some staff turnover at the city that was happening during the time of the project, and so that challenged our buy-in at the local level. And then I think maybe the most fundamental thing is this issue of marketing, and again, how to engage a diverse set of stakeholders in conversations where not everybody understands the language, or how a different discipline's resources might benefit the goals and objectives of theirs.

Organizational structure also presented some challenges for us. I mentioned earlier this issue of jurisdictional boundaries. So again the way that natural hazard mitigation plans are adopted are at a jurisdictional level. So for a downstream community it's really challenging for them to essentially identify and fund mitigation strategies in a completely different jurisdiction even though that strategy in and of itself may be the single best way to reduce risk. And so the floodwater storage example really illustrates some of those challenges.

City structures presented, you know, a little bit of constraint for us in terms of alignment of goals across different departments, and people are familiar with some of the challenges of not only disciplinary silos but also administrative silos within jurisdictions. So those are some of the lessons learned there.

And finally some of our key observations in terms of moving forward in ways to try and break some of those down is this opportunity to engage multidisciplinary teams. So where emergency management and water quality

might not be seen as complementary, trying to figure out ways to break down those barriers. And actually, you know, maybe there are opportunities through grant programs to require that communities are engaging different disciplines in their projects and in their activities.

Language and funding programs, again just to reiterate the alphabet soup challenges, through the process we came up with this notion of sort of rudimentary language learning for different disciplines. I'm blanking on the term we coined, I apologize. But essentially: getting emergency managers up to speed on water quality, grant funding sources and alphabet soup and vice versa so that they can try and better align their programs.

And then finally thinking about shared sets of principles. So one of the things that we've been increasingly doing in our community resilience work is less focus on individual hazards or specific outcomes and more focused on broad principles that can apply regardless of discipline or regardless of vulnerability sets. So diversity in redundancy as an example of a key resilience principle, that starts to maybe develop a common set of language that can apply regardless of who we're speaking with.

So with that I will pause and open it up for questions. Thank you.

Tyson Vaughan: All right, thanks Josh and Krista. That was fascinating. Thank you both for that presentation. So I'm going to stop the recording now and then we'll open to questions.

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