

2014 Green Infrastructure Webcast Series – Case Studies: Implementing Green Infrastructure under Enforcement Orders

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Speakers:

- **Emily Ashton**, ORISE fellow, EPA's Green Infrastructure Program
- **Andy Shively**, Kansas City Water Services
- **Kyle Dreyfuss-Wells**, Northeast Ohio Regional Sewer District
- **Tamara Mittman**, Environmental Engineer, EPA Office of Wastewater Management

Transcript:

Slide: Case Studies: Implementing Green Infrastructure under Enforcement Orders

Emily Ashton

Hey, everyone. We're going to go ahead and get started. Welcome to today's webcast titled Case Studies: Implementing Green Infrastructure under Enforcement Orders.

This webcast is sponsored by EPA's Green Infrastructure Program and the Office of Wastewater Management. My name is Emily Ashton, and I'm an ORISE fellow with EPA's Green Infrastructure Team. I'll be moderating today's webcast, along with my colleague, Eva Birk. We thank you for joining us today.

Slide: Logistics

Before we get to our presentations, I'd like to go over a few housekeeping items. First, we'll have a question and answer session after each of today's presentations. To ask a question, simply type your question in the "Questions" box on your control panel, and then click the "Send" button. If your control panel is not showing, click on the small orange box with the white arrow to expand it. You don't need to wait until the Q&A periods to submit your questions. There are a large number of participants today, so we encourage you to submit your questions early. We'll try to answer as many questions as possible, but due to the high number of participants, not all questions will be answered. Please feel free to contact the speakers after the webcast. The speaker contact information will be available at the end of the presentation. If you have technical issues, such as audio problems, please click on the "Questions" box to the right of your screen to type your issue and press the "Send" button, and we'll do our best to troubleshoot these issues. You can also call 800-263-6317 and give them conference ID Number 47835057. Lastly, we'd like to remind you that the views and materials presented by our speakers today are their own and do not necessarily reflect those of EPA.

Slide: Webcast Agenda

So what are we going to cover today? Today, we're going to be talking about green infrastructure and enforcement. Green infrastructure can provide cost effective, flexible, and environmentally sound solutions to meet Clean Water Act requirements. Green infrastructure

can also provide a variety of other community benefits, including enhanced ecosystem services, improved air quality, increase property values, energy savings, reduced urban heat island effects, and job creation opportunities. Given the multiple benefits of green infrastructure, communities around the country are increasingly incorporating green designs into wet weather controls to address compliance with the Clean Water Act.

Slide: Now to Our Speakers

So with that, I'd like to kick off today's webcast by introducing our first speaker, Andy Shively. Andy is the engineering officer at Kansas City Water Services Department. Andy attended the University of Missouri, Columbia, and attained his bachelors of science in Mechanical Engineering. He's a licensed engineer and has worked for the City of Kansas City, Missouri, for 20 years. In his current capacity as the engineering officer at the city's Water Services Department, he is responsible for planning and engineering of water and wastewater utility capital improvements. His work experience includes a multitude of administrative responsibilities, including design and construction of water and wastewater improvements and implementation of the city's \$4.5 billion Overflow Control Plan. Andy is an Envision Sustainability Professional, credentialed by the Institute for Sustainable Infrastructure, and enjoys collaborating with design professionals, contractors, government officials, and other stakeholders for the benefit of his fellow Kansas Citians. Now I will turn it over to Andy. Let's see -- Andy, are you there?

Andy Shively

I am here.

Emily Ashton

All right. Go ahead and take it away.

Slide: Investing in Kansas City: Improving Water Quality With Green Solutions

Andy Shively

I'm ready to go. Thank you, Emily. So good morning to those that are in the Mountain and Pacific Time zones, and I guess it's good afternoon to those still in the Central and Eastern Time zones. My name is Andy Shively, and I am the engineering officer for Kansas City, Missouri's, Water Services Department.

Slide: Overview

Today, I'm going to talk -- get back to my title page -- I'm going to talk first through an introduction of Kansas City, and specifically our Water Services Department. I'll go over our Overflow Control Program, and then I'll cover our green infrastructure program within the Overflow Control Program, and then our pilot project, and then how to maximize green infrastructure investments through partnership.

Slide: So Kansas City...

So Kansas City, in 2012 Kansas City was named to Frommer's list of top destinations, and it was the only American city to make that list. This is a picture of Kansas City's downtown skyline. It's the heart of our city, and it's the center of our infrastructure investments.

Slide: Kansas City, Missouri

And Kansas City, Missouri, is known as the City of Fountains. We're also known for our jazz and barbecue. We are home to the Kansas City Chiefs, the Kansas City Royals, and Sporting KC. On the right is photograph of me, so you can put a face with my voice. And just so you know, that is not an award I received for the installation of green infrastructure. That is the 2013 MLS Cup. So we're very proud of the fact that Sporting Kansas City, we're the 2013 champions.

Slide: Kansas City Metro

So the Kansas City metro area, the bi-state metro area boasts about two million residents. Kansas City proper covers about 318 square miles and has 460,000 residents. We were settled in the early 1700s on the banks of the Missouri River, and so today the Missouri River bisects the greater Kansas City area.

Slide: Water Services Department

The Kansas City area and its 460,000 residents is served by the Water Services Department. Our department is actually three utilities. We have a water utility, a wastewater utility, and a stormwater utility. We are an enterprise fund department, so all of our capital improvements projects are funded by the rates our consumer pays. So our operating budget is roughly \$300 million a year, split between the water and wastewater utility evenly and about 15 for our stormwater utility. The average monthly residential bill is about 82.50, 40 water, 40 wastewater, and 2.50 for stormwater. Again, it's the rates our customers pay that fund our capital improvements here in Kansas City.

Slide: Kansas City's Wastewater Utility

So our wastewater utility -- since drainage basins do not know city limits, we serve over 650,000 people. Our combined sewer area, in the older parts of the city, is from the Missouri River south, and it's outlined in green on the graphic to the right. And we face the same challenges as many municipalities across the nation, with aging infrastructure and under-funding in the past of our maintenance needs.

Slide: KC's Combined Sewer System

Within the combined sewer system, that covers roughly 58 square miles. Within that 58 square miles, we have 90 outfalls. Those 90 outfalls produce 6.4 billion gallons of overflow in a typical year, and that's what our overflow plan was to address. It also included the evaluation of green infrastructure and to capture 88 percent of that 6.4 billion gallons within the combined sewer system and, overall, reduce the number of overflows by 65 percent.

Slide: Overflow Control Program

So with our Overflow Control Program, it is Kansas City's largest infrastructure investment program to date.

Slide: Improving Water Quality

And why do we do it? Why are we going to spend four and a half to \$5 billion? And that's to improve water quality. It is a 25-year plan, and we were the first federal consent decree to include green infrastructure solutions. And we did take a city-wide approach addressing not just our combined sewer system, but our separate sanitary sewer system, as well.

Slide: Kansas City's Overflow Control Plan

So how did we go about developing our plan? We started with what was called a Wet Weather Community Panel to get buy-in from the community. We spent probably five years developing our Overflow Control Plan. Within the Overflow Control Plan, there were programmatic elements such as public outreach, education, workforce development, and there were also capital improvements that were identified within the Overflow Control Plan at improving water quality and reducing the volume and frequency of the overflows within our sanitary sewer system. So those capital improvements that identified water quality improvements, those are the items that went into the consent decree. Following the consent decree, we formed an Overflow Control Program. Our Overflow Control Program ensures compliance with the consent decree and execution of those other programmatic elements within the plan not related to the consent decree.

Slide: Kansas City's OCP Strategy

So our strategy in developing our plan, we wanted to maximize our benefits to the customers. We wanted to fix the system we had to address our aging infrastructure. We also wanted to reduce the problem before we had to solve it completely. We wanted to be able to reduce the amount of iodine getting into our system before we build storage for that volume of rainwater. We also wanted to facilitate the use of green infrastructure within Kansas City. After that, we would measure our performance and adjust the plan so in the end we only build what's needed.

Slide: Green Infrastructure Program & Pilot Project

Slide: Green Infrastructure Development

So within the consent decree, we used green infrastructure when negotiating with the EPA. So we were also the first to get a 25-year timeline. We were given an additional five years for the implementation of our green infrastructure pilots, and as I mentioned earlier, we were the first to include green infrastructure in a federal consent decree. So within the consent decree, we identified a little more than \$68 million worth of green infrastructure projects, and then we identified Middle Blue River Basin as a 744-acre project area to test some of our BMPs and their sizes and performance.

Slide: Green Infrastructure Development (2)

So with the development of green infrastructure, of course, they had to meet federal requirements, reduce the volume of stormwater entering the combined sewer system. We wanted to max mine the benefit to the community by creating amenities for them. And also, within the consent decree, we could replace gray infrastructure planned improvements with green, provided that they were similar in performance and similar in cost.

Slide: Kansas City's Program Implementation

So where are we now? Like I said, we had a 25-year program. We entered our consent decree in September of 2010, so we just entered our year four of a 25-year timeline. You'll see, at the top of the graph, the green infrastructure pilot project is one of the first out of the gate, and those green infrastructure pilot projects, of course, within our combined sewer system.

Slide: Middle Blue River Basin Green Infrastructure

So here's our Middle Blue River Basin green infrastructure area. The entire area that's colored is 744 acres. Our pilot area focused on the 100 acres in the upper left-hand corner, and we completed that in 2012, November of 2012, to be exact.

Slide: Transforming the Neighborhood

So to transform a neighborhood from this -- that neighborhood had unimproved streets, no curbs, gutters, or sidewalks and an aging combined sewer system. So we started there, and \$10 million later, we ended up here.

Slide: Transforming the Neighborhood (2)

Now, I'll get into that dollar figure here in a little more detail, but it was quite a transformation from one to another. And it took more than just money, believe it or not, to make that improvement. It took a lot of community involvement, and I'll get into the maximizing benefits of green infrastructure later on in the presentation.

Slide: Pilot Project: Investing in Kansas City

So there are the dollars. Of the \$10 million, \$6 million was spent on green infrastructure. We went in and rehabbed the existing sanitary sewer system, and that's your \$2.9 million, and then we did mill and overlay and added curb, gutter, and sidewalk to other areas of that project area at a cost of 1.4 million. Now, some of the curb and gutter that was needed to be installed in order to make the green infrastructure BMPs work -- so if curb and gutter was needed for a rain garden in order to merge the stormwater to that, then that would be included in the green infrastructure number.

Slide: Pilot Project: Green Improvements

So what did we build with the \$6 million in that 100-acre pilot project area? We put in 1,100 linear feet of permeable pavers. We installed 67 rain gardens, 28 curb extensions with rain gardens -- the curb extensions served not only as traffic calming but also provided increased storage area for the rain garden -- 4,300 linear feet of porous sidewalk, two cascade rain gardens, and then 36 bioretention rain gardens. I think, in all, roughly 135 BMPs were installed in the 100-acre pilot project area. I would also mention that within that area all of the BMPs were installed within public right-of-way. We did not install any of the BMPs on private property.

Slide: Pilot Project: Results

So what did we install in total? 360,000 gallons of constructed storage, which had a result of reducing peak flow by 76 percent at the pilot area outlet and also reduced the peak volume at the pilot area outlet by 36 percent. So these are the numbers that are important to the engineers.

Slide: Pilot Project: Community Benefits

And what the community saw in it was the amenities that we brought to the surface. I mentioned earlier that the goal of our plan was to maximize the benefit to the community. So if we're going to spend four and a half to \$5 billion, we didn't want all of that to be underground. We wanted to bring that to the surface so the community could see the dollars that are being invested and realize the benefits with the improvements made. So not only do they see improved water quality from the stormwater runoff that's captured by the rain gardens, they have increased green space and community pride. So it really transformed their neighborhood and improved community pride.

Slide: Next Steps: Middle Blue River Basin

So after the pilot project area, where would we go next? We look at the 644 acres in that 744-acre area. Collectively, we're calling that our Target Green Marlborough Area project. We did divide the project area into two parts, divided by outfalls. So in the bottom center of the screen, we have what's called our outfall O59, and then center right on the graphic is outfall O69. So we selected two design consultants to identify green infrastructure improvements and distributed storage for those two project areas. In total they were tasked with building 4.7 million gallons of storage, and they were also tasked with looking at strategic sewer separation within those two areas, as well.

Slide: Maximizing Green Investments Through Partnership

Slide: Partnership

So maximizing the green infrastructure through the partnerships -- when we started the 100-acre pilot project area, it started with a lot of public outreach. We started in the community and with the neighborhoods' home associations and the groups within that 100-acre area. So we included all the neighborhood and residents. We also brought in our other city departments, our city Planning and Development, our Public Works Department. And we also met with our local contractors -- that's both our design professionals and our construction contractors. We wanted our design professionals to think outside of the box, and we wanted the input from our construction contractors on the constructability of these needed improvements and also to minimize the disruption to the community. And one of the things that we heard from the neighborhoods and residents is that the right hand doesn't know what the left hand is doing at the government level. So they wanted this collaboration, they wanted the cooperation, and they wanted a holistic approach taken to this improvement area so we could come into this area at one time, do what was needed all at once, take care of the infrastructure needs, and then back back out, rather than streaming these improvements out over several years. So if they were going to have to go through the disruption of construction activities, they'd rather eat the whole apple at once than just take a bite out at a time. So that's what we strove to complete in this 100-acre pilot project area through collaboration with other departments and

utilities. We also worked with our local gas utility so they could come in at the same time and replace their aging gas lines in this area, as well.

Slide: Partnership: Neighborhood & Residents

And so one of the first things we heard when we started talking to them about combined sewer overflows and improving water quality and the needed work in their neighborhood, they wanted to talk about the streets and sidewalks and curbs and gutters. So we found out very quickly that when you start getting their input, your scope of work gets real broad real fast.

Slide: Partnerships: City & Government

So this just lists some of the other city departments and government agencies that we reached out to in developing a 100-acre pilot project area for green infrastructure. Start at the top, with our EPA Region 7. I mentioned our local gas utility, Missouri Gas Energy. We reached out to a local university, the University of Missouri at Kansas City. And then the other city departments, Neighborhood and Housing Services, I mentioned Planning and Community Development earlier, and then our Parks and Recreation department as well as Public Works Department. So in the end, we were able to get their ideas on how we could improve the project in that area and minimize the disruption and maximize our efficiency and the number of resources we could throw at this project at once.

Slide: Partnerships: Local Contractors

I mentioned earlier our partnership with local contractors. We reached out to the design professional community and the construction community to get their input on what would help make this project a success. And also, we wanted to invest in our local workforce and develop their green skills capability. So by reaching out to them and pulling them into this design process, we helped strengthen our community and also, I believe, make a very successful green infrastructure pilot project.

Slide: Green Infrastructure & Urban Planning

So after the 744 acres, or the remaining 644 acres, we're also taking a big picture look on how the green infrastructure projects can further community improvements beyond just that 744-acre Middle Blue River Basin area and how the green infrastructure amenities that are going to be installed above ground can help revitalize the neighborhoods and, ultimately, support economic growth in those areas. And with that -- I think I went through probably a little faster with time, Emily -- but I'll turn it back to you so you have an opportunity to ask questions.

Slide: Questions

Emily Ashton

Okay. Thank you so much, Andy. Actually, right now I'd like to run a poll real quick with the audience. We're just going to send that out. It should show up for everyone in the audience. If you could just take that poll, and then we will get to some questions.

Okay. So it looks like we have almost everybody voted in the poll. So Andy, let's get to some questions. First, I'd like to mention there was a lot of questions about if we're going to be

sharing the slides. We will have slides and a transcript available within the next several weeks, which would be posted on the green infrastructure website. So, Andy, one of the questions that we had was about quantifying BMP performance. So we want to know: How did you quantify BMP performance in terms of flow reduction? Did you use preexisting studies or just in the pilot project area?

Andy Shively

Good question. Within the pilot project area, we did both pre- and post-flow monitoring and, of course, used -- we had a hydraulic model or stormwater model that was built. So with preconstruction flow monitoring, we knew what our flows were, and we built the model. And then after completion of the construction in November of 2012, we did post-construction flow monitoring and then calibrated the model with that data. And the numbers that I showed, the 360,000 gallons of storage, that slide that showed the reduction in volume and peak flow are the calibrated model results from post-construction flow monitoring.

Emily Ashton

Okay. Great. Thank you. Another question that we got was: How did you fund the street improvements?

Andy Shively

The street improvements were funded by our Public Works Department and some by Water Services, so it was a shared cost. Some of our construction activities damaged the pavement within the right-of-way. So like on any normal construction project, if we disturb the existing pavement or existing curb gutter and sidewalk, then our construction activities would then be responsible for the restoration of that infrastructure. So it was a shared cost between Water Services -- we allocated the costs based upon the areas disturbed, and so both Water Services paid and our Public Works Department paid.

Emily Ashton

Great. So the last question I'm going to throw at you is some of our audience wanted to know: Who was responsible for the rain garden maintenance? How is that process going, and did you get any cost performance data from that?

Andy Shively

That is also a good question. There's two points I wanted to bring up in talking with the residents, when we went through that process. We spoke with them both before, as I mentioned, during -- establishing the design criteria and identifying the improvements and the type of improvements and where those improvements were being installed. And in part of that process, we used artists' renderings to depict the work that would be done. And then post-construction, we went back and met with all the residents to determine the success or failure of the work that we did in that area. And what we learned is that we hired too good of an artist. The artists' renderings looked very pretty and good, and what we heard was that, "What you installed doesn't look anything like the painting that you showed me." So we have to be very careful going forward, when we provide those types of artists' renderings and graphics, that they are as realistic as possible because the expectation becomes the picture that you showed, they think that's exactly how it's going to look when you're doing post-construction.

And to address specifically the question that was raised regarding maintenance, within that 100-acre pilot project area, included with the construction contract, we added a three-year maintenance provision with the contractor. So now we're in year two of that maintenance contract, so right now we have private contractors going into the 100-acre pilot project area to address our maintenance needs there. But we know that that three-year contract is going to run out shortly, so we've been working internally to see who's going to be doing the maintenance on all of our green infrastructure going forward because, within the other 644 acres, we are developing green infrastructure improvements. And there are already green infrastructure improvements throughout the city, not built just by Water Services, but other departments such as our Parks and Recreation department. I know our Area Transportation Authority had some green infrastructure improvements built in one of their bus corridors. And so after all the green infrastructure has been built, our departments kind of looked at one another and said, "Well, who's going to maintain this green infrastructure now that it's constructed?" So we're working collaboratively to develop a plan on who's going to be long-term doing the maintenance on all of our green infrastructure improvements here in Kansas City. And also, as an interim step while the contractor is doing his work, we've also formed a Green Solutions crew within our Stormwater Maintenance Division, and that crew right now is assisting in the pilot project area and going out to the other BMPs located throughout the city and doing maintenance there. So we're developing the resources internally through Water Services Department while it's under contract in the pilot project area, and going forward, as a big picture for Kansas City, we're working with the other departments to develop a strategic plan on addressing the maintenance of green infrastructure needs in the future.

Emily Ashton

Great. Thanks, Andy. Actually, we had sort of a follow-up question to that. Somebody from the audience asked: Who guarantees the regulatory compliance to ensure all of this maintenance that you're talking about?

Andy Shively

I'm not sure that I -- the regulatory compliance comes in with the percentages. So within our consent decree, there are performance measures. And it's percent capture by volume and the number of overflows at an outfall. So that's the performance criteria and measurement within the consent decree, and that would be the regulatory requirements that we would have to adhere to there. So there's a maintenance requirement to make sure that the BMPs are performing -- so maybe that's the nature of the question -- and that's -- Water Services Department is responsible for the maintenance of those BMPs that we installed in the pilot project area, ultimately to ensure compliance with the consent decree.

Emily Ashton

Yes, that makes sense. Okay, well thank you so much, Andy. I think we're going to move on to our next speaker now, so I just want to thank you so much for your presentation.

Andy Shively

Thank you, Emily.

Slide: Second Chances: Retooling a Great Lakes City with Green Infrastructure

Emily Ashton

All right. So now we're going to switch to our next speaker, Kyle Dreyfuss-Wells. And I'll go ahead and introduce her as we switch to her screen. Kyle is the manager of watershed programs with the Northeast Ohio Regional Sewer District. Kyle coordinates the district's watershed management efforts across district programs, including the application of stormwater control measures to combine sewer overflow control through the district's green infrastructure program and implementation of watershed management and stream restoration projects across the district's 62 member communities. She is the chair of the National Association of Clean Water Agency's Stormwater Management Committee and vice chair of the Urban Water Sustainability Council of the US Water Alliance. Ms. Dreyfuss-Wells received her bachelors of science in Biology summa cum laude from the Ohio State University. She received a master's in Public Affairs and a master's in Environmental Science with honors at Indiana University's School of Public and Environmental Affairs and served as a Peace Corps volunteer in Samoa. Before joining the district, she was director of Chagrin River Watershed Partners, incorporated. I'll go ahead and pass it off to Kyle. Kyle, are you there?

Kyle Dreyfuss-Wells

I'm here. Can everybody hear me?

Emily Ashton

Yep, we're good to go, so take it away.

Kyle Dreyfuss-Wells

All right. Well, thanks, everybody, and thanks for having me. It's great to be on this webcast, and I certainly learned a lot from an Andy's presentation. So I'm going to talk to you about the Northeast Ohio Regional Sewer District's Green Infrastructure Program. For some reason, my slides are not advancing. There we go.

Slide: Northeast Ohio Regional Overview

I'm going to talk to you about the Northeast Ohio Regional Sewer District and what we're doing on green infrastructure under our federal consent decree, as well as our Regional Stormwater Management Program and how that connects to our Green Infrastructure Program.

Slide: District Overview

So here we are, nestled on the balmy shores of Lake Erie, and you can see the other urban areas that surround our service area.

Slide: Who We Are...

So we are a regional sewer district serving a service area of 355 square miles. We provide sanitary and stormwater management services to the city of Cleveland and 61 surrounding communities spanning all or portions of four (inaudible) counties. We are a political subdivision of the state of Ohio, so we're an independent regional district formed under Ohio Revised Code 6119, in case anyone is following along in their Revised Code. We were created by court order in 1972, and we have our own separate code of regulations. And we're governed by a

seven-member board of trustees which is appointed in various combinations by the City of Cleveland, the county executive of Cuyahoga County, and then our suburban mayors. And we are separate and distinct from the City of Cleveland and Cuyahoga County.

Slide: What We Do...

And what we do, as I mentioned, is provide sanitary and regional stormwater management services to the city of Cleveland and then the outlying suburbs. We have about a million customers, and 90-plus billion gallons on the sanitary side are treated each year at our three wastewater treatment plants. We also do extensive water quality monitoring on the Cuyahoga River and Lake Erie, and we do beach monitoring and maintenance in partnership with the Cleveland metro parks on the great lake of Lake Erie.

Slide: We Own and Operate 3 Wastewater Treatment Plants

So in terms of our core business, it's operating these three large wastewater treatment plants. And I just want to make sure everybody realizes that, that that is a big component of what the Northeast Ohio Regional Sewer District does.

Slide: Northeast Ohio Regional Sewer District Responsibility

But in terms of what we're talking about today, we have two big wet weather programs. And they are Project Clean Lake, which is focused on combined sewer overflow control. And as Andy talked about, we are also under federal consent decree. Up until five minutes ago, I thought we were the first, but now that has been completely shattered because our consent decree was signed in December of 2010, right after Kansas City. So we are the second federal consent decree to include green infrastructure. And we're looking at about \$3 billion over 25 years for CSO control, and that is funded completely through our sanitary sewer fees. Our other big wet weather program is our regional Stormwater Management Program, which is focused on everything else related to stormwater besides combined sewer overflow control, mostly flooding and erosion issues across our service area. And that is funded through a separate impervious surface-based fee. I mention that program, although I'm not going to talk about it a lot in this presentation, just to make sure everyone realizes that our Green Infrastructure Program also includes this Regional Stormwater Management Program. But unfortunately, that program is suspended at the moment because it's in front of the Ohio Supreme Court. So I'll just stop talking about our Regional Stormwater Management Program at this time. All right.

Slide: Project Clean Lake: The gray and the green of CSO control

So let's talk about Project Clean Lake, which is a mixture of gray infrastructure and green infrastructure for combined sewer overflow control.

Slide: What is a Combined Sewer?

And before we talk about combined sewer overflow control, let's make sure we all know what a combined sewer is. This is the inside of a combined sewer system, where stormwater and sanitary water are intentionally combined. And back in the day, this is the way things were done. Dry weather flow, sanitary flow just goes directly to the treatment plant. We can also handle a little bit of additional wet weather flow, and we have the capacity to handle that within

the combined system, send that to the treatment plant, treat it, and then discharge it to the Cuyahoga River or Lake Erie. When we have large rain events, however, we overflow the system, and that is discharged directly to the environment untreated. And that is a combined sewer overflow. And if you were watching me right now, you would actually see my combined sewer overflow interpretive dance that I do with this graphic, but the limitation of the webinar is you can't see that.

Slide: What is a Combined System Overflow?

So a combined sewer overflow looks like this. This is the top of the Mill Creek Falls in Cuyahoga county. That gray piece of infrastructure is the result of a combined sewer overflow, and so that is untreated stormwater and sanitary mixture coming to the environment. This overflow actually has been eliminated through one of our tunnel constructions, so that is no longer there. And there are significant water quality impacts (inaudible) of combined sewer overflow.

Slide: Water quality impacts of Combined Sewer Overflow....

So if you look across our service area, you see that we are both combined and separate. And this graphic shows in gray our whole service area, and then the green area is that portion of our service area which is combined.

Slide: Combined Sewer Map

So similar to Kansas City, we have both separate and combined systems.

Slide: 126 CSO Locations Throughout Combined Sewer Area

So our combined area, if we zero in on that, is the city of Cleveland and about 11 surrounding inner-ring suburbs. And it's 126 total CSO locations that discharge untreated storm and sanitary and that we will take care of through Project Clean Lake. And that -- I'm going here. Hold on, folks, I'm trying to advance these slides, and they're not advancing. There we go.

Slide: Consent Decree Requires Northeast Ohio's CSO Problem Reduced in 25 Years

So our consent decree requires that we reduce combined sewer overflow by a total of 98 percent capture. And when the district was first formed in the 1970s, we had nine billion gallons of untreated combined sewer overflow in a typical year.

Slide: CSO Long-Term Control Plan Consent Decree

Through the good work of the district, we've actually reduced that to 4.5 billion gallons, where we stand today, and under Project Clean Lake, we will reduce that to less than half a billion, or 98 percent level of capture.

Slide: CSO Consent Decree includes two options for Green Infrastructure

And before I talk about the green infrastructure projects that we're going to go under Project Clean Lake, I just again want everyone to note that we have a lot gray infrastructure necessary to get to that 98 percent level of capture.

And I'll just take you through how we got to the consent decree that we have today. As I mentioned, the district had some of our combined sewer overflows that overflowed up to 80 times a year. We went from that nine billion gallons that we had in the '70s to four and a half billion gallons in a typical year that we have today. To get that initial cut at the nine billion gallons, it was about a billion dollars of investments. When we first went into negotiations, we were looking at a plan that had four -- that would go from the 80 overflows a year to less than four overflows a year, about a billion gallons remaining, 30 years to do that, at a \$2.3 billion price tag. Where we stand today, with our consent decree, is between two and three overflows is what we will get down to with Project Clean Lake, a remaining overflow volume of less than half a billion, 25 years to do that, an estimated \$3 billion price tag, and a 98 percent level of capture. And I'm just going to say that 98 a couple times so everyone realizes what a high, high, high level of capture that is -- a lot of gray infrastructure, but then also green infrastructure in our consent decree.

Slide: CSO Consent Decree includes two options for Green Infrastructure (2)

And I'm going to talk about the green infrastructure components of our consent decree so that you can go home tonight and read those because they're total page turners. So there's two appendices to our consent decree. The first is Appendix 3, which is gray plus green. And for the rest of my presentation, it's very important to understand what that is because I think this is actually unique nationally. So our Appendix 3 requires us to get an additional 44 million gallons of combined sewer overflow control above our gray infrastructure. So it assumes full construction of the gray infrastructure and then an additional 44 million gallons of CSO control through green. That's Appendix 3. Our Appendix 4 is gray versus green. And so we don't set up that adversarial thing between gray and green, we'll call it right-sizing the gray using green. And that allows us to replace any piece of gray infrastructure with a piece of green infrastructure if it provides an equivalent level of performance and cost.

But I'm going to talk about our Appendix 3 green infrastructure projects, which is that 44 million gallons of additional CSO control with a minimum spend of \$42 million. And that runs between now and the next five years.

Slide: Consent Decree Timeline

So this graphic shows you our timelines for green infrastructure, and then, on the bottom, you see, from 2011 to 2036, our gray infrastructure just cooking along while our green infrastructure meets various construction, monitoring, and compliance deadlines.

Slide: Components of the Long-Term Control Plan

So again, we have a program that is a mixture of gray and green, tunnel construction, optimizing our existing sewer system, improving our collection systems to get about four billion gallons of control, and then another 44 million gallons of CSO control, to meet our 98 percent level of capture.

Slide: Components of the Long-Term Control Plan

So on the green infrastructure side, we have looked across our combined sewer service areas to find these opportunities. But again, I want to note that under Appendix 3 we have a couple constraints under our mandatory green infrastructure. We can only look in those portions of our

sewer sheds that will have remaining overflow volume after completion of the gray infrastructure. And we need to obviously build that within our combined sewer service area.

Slide: NEORS GREEN INFRASTRUCTURE

So this graphic, the purple is the outline of the city of Cleveland. The gray areas are our combined sewer area, and the blue areas, which have the watersheds highlighted, are those that will have remaining overflow volume after construction of our gray. And that is where we looked for our green infrastructure projects. So I'm going to refer to those as our mandatory green infrastructure projects or the 44 million gallons of additional control green infrastructure projects.

Two other really important things to keep in mind about our program is that, because we are building the gray infrastructure, and that gray infrastructure is designed to capture stormwater, we have to capture a significant amount of stormwater to make a dent in combined sewer overflow. So the ratios are high, and you see there, for example, in our southerly district, we have to capture five gallons of stormwater to make a dent in one gallon of combined sewer overflow control. And we're tracking about, for that 44 million gallons of CSO control, we're going to need to capture about 267 million gallons of stormwater.

Slide: Northeast Ohio Regional Overview

And then we also have significant vacant properties across the city of Cleveland and our inner-ring suburbs. These are a negative, obviously, for our region, but they are a positive in terms of being able to reuse them for green infrastructure. And we are doing that as part of our green infrastructure plan.

Slide: Project Clean Lake - Promoting GI for CSO Control in Cleveland

And this shows that the city of Cleveland and our metropolitan area has lost significant population from the 1950s, almost a 60 percent decline. And you combine that with the foreclosure crisis, and obviously we have a vacant property issue. We're trying to use that for green infrastructure. So when we're promoting green infrastructure across the city, we are working closely with the City of Cleveland. I like to say that they have the land, and we have the mandate. And we're working with our community development corporations and neighborhoods and trying to build off of development activities.

Slide: No stormwater runoff from this site through the 100-yr storm

A great example of that is our partnership in the University Circle neighborhood with the Courtyard by Marriott. So what you're seeing here is a picture before this project was put into place. This is near Case Western Reserve University, the Cleveland Museum of Art, our main hub for education and medical activity. They wanted to put a hotel here, came to us to talk about stormwater management, and we said, "If you get the hotel roof and we get the parking lot, we're willing to talk about green infrastructure."

Slide: Photo

So we partnered with them on this project and picked up the drainage from both the hotel roof and the parking lot. This has the great opportunity on sitting on old beach sand, and so the

infiltration capacity of this site was phenomenal. So with the green infrastructure that we've constructed on this site, we'll have no stormwater runoff from this site through the hundred-year storm. This was constructed in August of 2013. There's a picture of the built hotel and then, more importantly, the pervious paver parking lot that is serving that site.

Here's the underground storage chambers, the pervious paver construction going in, and this site was completed in August of 2013. And we have monitors looking for overflows from this site, and we have had no runoff from this site up to this point, even though we've had some really big rain events.

Slide: Keeping Our Great Lake Great

So this is one example of our Green Infrastructure Program in action and great partnerships. And there's the sign which we love to show the connection between the Courtyard Hotel and the ducks of Doan Brook before it discharges to Lake Erie.

Slide: Map

Just a couple other projects, we talked about the University Circle green infrastructure projects. Our other mandatory green infrastructure projects are shown here on this graphic. It totals ten more projects from 2013 to 2019. We're looking at about 46 million gallons of CSO control and actually, instead of the \$42 million, we're on track to spend about 80 to \$100 million on those green infrastructure projects.

Slide: Fleet Avenue Green Infrastructure Project Map

I'm going to talk to you about Fleet Avenue, which is the second of our green infrastructure projects for CSO control. Fleet Avenue is in the Slavic Village neighborhood of the city of Cleveland, again, a neighborhood that was really hit by the foreclosure crisis, significant amount of vacancies. The Community Development Corporation there, in partnership with the City, is doing a wonderful renovation of Fleet Avenue, sort of the main drag of this neighborhood.

Slide: Fleet Avenue Green Infrastructure Control Measure

They're doing street reconstruction and green infrastructure along this street. We are coming in with an infiltration park-like feature at the intersection of Fleet Avenue and 53rd, taking three vacant parcels, less than half an acre, and building an infiltration basin with a wonderful plaza that serves as the bus stop for this area.

Slide: Fleet Avenue Green Infrastructure Project Pictures

The question came up about maintenance. We're on the hook to maintain these and to own these forever. So this Fleet Avenue infiltration basin will pick up the drainage from about 11 acres tributary to this area. It's going to cost us -- you see here, we estimate the construction costs to be about 1.3 million. It's going to capture nine million gallons of stormwater in a typical year and give us .9 million gallons of CSO reduction. So those are those ratios popping up again.

Slide: Map 2

The second -- or the third project, the third and last project -- so prepare yourself -- that I want to talk about is our Urban Agricultural Innovation Zone.

Slide: Map 3

This project is a little bit different than the Fleet Avenue project, although it is also reusing vacant properties. Our Urban Agricultural Innovation Zone is about a 72-acre drainage area on the east side of the city of Cleveland.

Slide: Site of Urban Agriculture

This area, in the 1950s, was a well-populated residential neighborhood that has been vacant for quite some time due to various environmental justice issues that have hit this area.

Slide: Map 4

So today, it is majority vacant on the east side of the city. And because of this concentration of vacancy, the Community Development Corporation there really saw it as a hub for urban agriculture.

Slide: Map 5

And we have come in -- this graphic here shows in red the number of vacant and distressed parcels in that area.

Slide: Urban Agricultural Innovation Zone – Existing Conditions

We have come in and partnered with them in implementing a green infrastructure project in this neighborhood, and there's your existing conditions in the Urban Ag Zone, significant dumping –

Slide: Urban Agricultural Innovation Zone – Existing Conditions (2)

I want to just let everybody know that this has actually been cleaned up -- and there's wonderful pioneers in this neighborhood that are doing great urban agricultural activities.

Slide: Rid-All Green Partners – Urban Agricultural Innovation Zone

Slide: Map 6

Slide: Map 7

So we will work with them to build new separate storm sewers, put in new streets, repave streets, four bioretention features to manage the separate stormwater from this area, and discharge that actually directly to the environment after this goes through these water quality features. And it goes into Kingsbury Run, pulling it out of the combined system.

Slide: Rendering

And this rendering shows the before and after for one of those green infrastructure features that we'll build in this neighborhood, and it's really acted as a catalyst to move the Urban Agricultural Innovation Zone along.

Slide: Table 1

This project, the numbers are actually a little different because the sewer district is doing the full list. It's about five and a half million dollars for construction, which includes separate sewers, new streets, bioretention features. We're getting about seven million gallons -- actually, I need to update that number -- seven million gallons of stormwater, which translated to 1.3 million gallons of CSO, which hits against that 44 million gallon mandate.

Slide: Assessment of Benefits

So on the cost side, our Combined Sewer Overflow Control Program, as I mentioned, includes gray and green infrastructure. Our gray infrastructure is actually quite cost effective, coming in at about 75 cents a gallon. Now, to get some of the last remaining volume, it would have been expensive for us to go with gray. And that's where green infrastructure is coming in as being cost competitive. But it is a buck 79 we're seeing per CSO gallon.

Slide: Assessment of Benefits (2)

Lifecycle costs are obviously things that we're looking at, and then we're just about to start a co-benefits analysis of our gray and green infrastructure. And that will be done in 2015.

Slide: Addressing flooding, erosion, and water quality

I'm going to close by just mentioning that we do have a stormwater program which is an essential component of green infrastructure for us.

Slide: Impervious surfaces

This is looking at our impervious surfaces across our service area, the flooding problems that we have,

Slide: Middleburg Heights/Brook Park, Ohio along Abram Creek

the erosion problems that we have related to impervious surfaces, and encouraging on-site stormwater management practices, good practices through this new impervious surface fee and related credits. So we have a fee on impervious surface.

Slide: NEORS D Stormwater Supports GI

Slide: Stormwater Fee Credits

We have credits which obviously encourage folks to manage stormwater on their sites, which is green infrastructure. And this just shows a couple examples of the kind of good on-site practices that our stormwater program encourages.

Slide: Grant programs

But again, just in case anyone that's listening that's in the litigation, that program is on hold.

Slide: NEORS D GI for CSO Control Summary

So to close, Project Clean Lake does include significant green infrastructure commitments. We're actively seeking to exchange gray infrastructure for green infrastructure. Volume control is a really interesting issue for us, where stormwater capture does not equal CSO reduction. And our Regional Stormwater Management Program, with its impervious surface fee, is an essential component of that. And then I'll just point folks, if you want to see more about green infrastructure in Cleveland, there's great stuff on our blog. So I think that's it for me.

Slide: For more information

Emily Ashton

Thank you, Kyle. That was really great. We are going to go ahead and have another question and answer session with you, if that's okay. The first question we'd like to know is -- you pointed out some of the areas where you prioritize green infrastructure. And we would like to know, on a site-by-site basis within those areas, did you have any system that prioritized where the green infrastructure would be implemented?

Kyle Dreyfuss-Wells

Yeah, so we went through a process where we looked -- obviously, the main thing is the remaining overflow volume. So we had to go to those sections that had remaining overflow volume. And then we looked for a couple things. We looked for concentrations of vacant parcels where we could construct green infrastructure, and then we also looked for partnerships. And you'll see that University Circle, Urban Ag, and Fleet Avenue are all us partnering with someone else. So we like to come right behind a good idea. And I would say that those partnership opportunities were one of the main drivers with where we located once we had the hydrology correct.

Emily Ashton

Great. So the next two questions are actually on maintenance, which is a topic that everyone wants to know more about. One of the questions we got was: Do you confront any issues with winter maintenance?

Kyle Dreyfuss-Wells

I'm sure we will confront issues with winter maintenance. The -- actually, that's a good point. So the one project that we have that has wintered is our University Circle hotel pervious paver parking lot. And that has not -- we have not had any significant issues with maintenance. And I think folks generally find that the pervious pavement systems function quite well in winter in terms of having limited ice and not having as many slip hazards. So that project has actually gone through the winter quite well. Fleet Avenue and Urban Ag have not yet been constructed, so we don't know the details of that yet.

Emily Ashton

Well that's good news, to hear that that parking lot has wintered over quite well.

Kyle Dreyfuss-Wells

Yeah, no one has complained, and I'm sure they would complain if there had been a problem.

Emily Ashton

So following up on that maintenance question, another question that we got was: Are the long-term maintenance costs included in your initial cost projections, or is that somewhat of an overhead?

Kyle Dreyfuss-Wells

Yes, so that \$80 million which is what we're putting at the 44 million gallons at right now, that is just construction costs. It does not include the maintenance costs. That's what we're looking at now in terms of, as we go into our cost benefit analysis and compare the life cycle costs of gray infrastructure and green infrastructure, we will look at those O&M costs.

Emily Ashton

Uh-huh. So thank you, Kyle. Actually, we're going to have -- we'll have one of our colleagues here wrap up with just a few words. I'd like to introduce her. Her name is Tamara Mittman, and she's just going to have just a few words before we have one last Q&A for both of our panelists.

Tamara Mittman

Thank you, Emily, and thank you to our panelists. One thing that we just wanted to point out is that these two case studies represent how all situations are a little different, depending on the way the consent decree is structured and depending on the performance goals. We've found that different communities will end up with different strategies and different kind of practices, depending on their performance goals, and we do foresee that in the future a lot of times the solution will be smaller decentralized practices that enhance infiltration and evapotranspiration, so we just wanted to point out that there are many different approaches out there, and these were two case studies that really emphasized the range of approaches.

Emily Ashton

Thanks, Tamara. I'm actually going to bring Andy back online. Andy, are you there

Andy Shively

I'm here.

Emily Ashton

Okay, great. So we'll just have one more question for both of you. You can answer one after the other if you'd like. One of the things that we'd like to know was: How do you encourage commercial developers to incorporate green infrastructure?

Andy Shively

Kyle, do you want to go first?

Kyle Dreyfuss-Wells

Yeah, so I'll -- there's three ways that we do that. Obviously, the most effective way was when our regional stormwater management fee, the impervious surface fee was in place. We had a lot of great interaction with private sector developers through our credit program, where folks

would look to put on-site green infrastructure practices in order to get those stormwater fee credits. With that program suspended, we encourage that now through technical assistance. It's amazing how far technical assistance will get you in terms of helping folks understand what they can do. So we do that, and then we also have a grants program where we provide some limited funding to pay for the delta between what folks would do and what they could do when it comes to green infrastructure.

Andy Shively

Emily, are you ready for mine?

Emily Ashton

Yes, go ahead, Andy.

Andy Shively

All right. So in Kansas City, our city Planning and Development Department controls our site development. So they're the ones that will be working with our commercial and residential developers. So within the city Planning and Development Department, there are their rules and regulations and their codes which govern the practices for development here in Kansas City. So what they're doing, when they're doing the site review and the plan review, and by our code and ordinances and the department's rules, they're able to enforce the stormwater detention on that site development. In other words, you treat it where it falls. So they must capture, I believe it's up to, I think, a ten-year storm on site. So they're doing that at their level on development going forward. So they do the plan review, the amount of runoff generated from -- because each development is unique. So it depends on what they're development and the size of the acreage and the basin. So they do all of that review, and then they do that enforcement there.

Kyle Dreyfuss-Wells

And I'll just add, I forgot to mention that, which is crazy. We also have regulatory authority within the combined sewer area. And so we review plans and require on-site practices to make sure that folks don't increase CSO volume.

Andy Shively

Yes.

Emily Ashton

Okay, great. Thank you, guys, so much for your great answers to these questions. We have a little bit of time left. I wanted to see if either Andy or Kyle had any parting comments or anything that you'd like to add in light of the other person's presentation.

Andy Shively

I learned a lot from Kyle's presentation, so I appreciated the opportunity today. And Kyle, I'll probably follow up with you following this presentation in the future to learn about what you're doing in your area. So thank you, and thank you, Emily, for the opportunity to participate.

Slide: Speaker Contacts

Kyle Dreyfuss-Wells

Yeah, same for me. I think we learned a lot. There's a lot of us here, at the Sewer District, listening, and your Kansas City presentation was quite helpful. I do want to just emphasize, you know, Andy talked about going out and meeting with the public, and we want to talk about combined sewer overflow control, and they want to talk about streets and maintenance. And that is, I think, probably universal. Folks are very focused on infrastructure and have specific issues that need to be addressed. And the creativity comes from trying to hit all of those, ring all those bells with one project while meeting your consent decree requirements.

Slide: Next Webcast

Emily Ashton

That's a great point, Kyle. So I guess we'll go ahead and just wrap up here today. I'd like to thank Andy and Kyle and Tamara for joining us and all of our participants for listening in. Please continue to check the EPA's green infrastructure website for the most up-to-date information on our 2014 webcasts, and join us for our next webcast on May 6th. This ends our webcast for today. Thanks for joining us.