SNEP Symposium – Science Bringing Solutions Delivering Environmental Improvement to Southeastern Coastal New England

Main Meeting Room, Keynote Speaker

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Adam: So again, thank you all for joining us, I would now like to introduce our keynote speaker, Dr. James Houle. Dr. Houle's is the director for the stormwater center at the University of New Hampshire. His responsibilities include directing and managing the stormwater center's growing body of research projects. In this presentation, in his presentation today, Dr. Houle will be introducing the stormwater retrofit manual that the stormwater center has been developing in partnership with our SNEP network. Dr. Houle's areas of expertise include diffusion of innovative stormwater management solutions the design and implementation of innovative stormwater control measures including green infrastructure and low income or excuse me, low impact development strategies planning and implementation operation and maintenance and water resource monitoring. Dr. Houle's holds a PhD in natural resources and environmental science and has over years of experience with water quality related issues in New England and is a certified professional in stormwater quality and a certified professional in erosion and sediment control; so Dr. Houle I will go ahead and yield the floor.

James: All right thank you Adam. Let me share my screen and just verify that you can see the full presentation.

Adam: Looks good James.

James: Okay, perfect. Thank you Adam and thanks for having me. It's a pleasure to be here. I am the director, as Adam said, I'm the director of the stormwater center but also a part of the SNEP network team and one of our big projects under the network umbrella is the development of this retrofit manual and I'm not the only one working on this; we're working with a very able team and it's being led by VHB, that's Nate Pacheco and Theresa McGovern and also we're relying heavily on Mark Voorhees and his participation particularly with respect to some of the crediting and design tools that have been developed by Region One. I was really happy to hear Dr. David Cash's opening remarks and admittedly a huge fan of his. I referenced him in his work prolifically in my doctoral research that really centered around developing scholarship and institutional approaches that harness the science of technology that we're developing and harnessing it in particular for sustainability and that's not just sustainability on the environmental side but also pragmatically in our long-term municipal operations and maintenance of our stormwater programs and also economically making sure that we can do this, meet water quality targets and objectives in an economical way so really that next is what this retrofit manual is all about it's harnessing the implementation experience that we've developed over the years and trying to put it and codify the tools that EPA Region One has developed and operationalizing it in a manual for this niche of retrofit which is really, you know, it's not a new development, it's not a redevelopment, it's an opportunity or planned effort of working in the already built environment.

So I want to start with, just the story of kind of why retrofits and retrofit manual matters and it ultimately involves implementation. I feel like we're moving from a planning economy and a planning centered effort to an implementation economy and an implementation-centered effort and when you start to implement there's definitely some differences and so I want to talk a little bit about some feasibility assessments that we did in Dover New Hampshire around the Barry Brook and you might have heard about some of that work however you might not have heard about the story of actually the retrofit of the old historic waterworks yard so the Dover waterworks building, was built around 1888 and it had a number of, you know, historic infrastructure that managed and delivered clean water. We thought for the most part that the majority of that had been removed outside of this building that you see here.

Because in the backyard it had historically just been used for a staging area for aggregate and other materials and old pipe and, you know, our thought was we'd clean this up, we'd daylight the stream that was in a pipe and we turned this into a multi-use recreational pathway and also a usable kind of restored area.

Upon some of our more in-depth surveying that we're doing in preparation for grubbing, we discovered the crypt which was news to us and it was essentially this entrance way into a 1908 era, 40,000 square foot underground drinking water treatment sand filter. So putting the historic nature of it aside which we cue the 106 permit which we successfully navigated and it was a pleasure to really, you know, talk about the historical feature. I think this is one of the last slow filtration sand filters that is in New Hampshire and we were able to document it but it was kind of a pretty big illustration of how when implementation actually occurs and shovels go in the ground we find out things that we didn't know that we couldn't have known that we need to be adaptable to and flexible with so that's really what the manual is all about is providing that flexibility so we can adapt these innovations to the built environment which always is going to have some surprises for us.

So this is just a kind of time lapse photograph moving from the original site. I'll just back that up one more time, the original site to the way it was restored and the way it looks now so we removed some of the building you can see the new water treatment plant here right next to the historic feature and you can see kind of the sinuous a stream that we restored that was formerly in an underground pipe, so that's the headwaters of Barry brook we also restored this wetland upstream of it and that all intersected you can barely see the remnants of the old 40,000 square foot sand filter.

So there's always surprises and there's always a need to adapt our designs and our approaches to work in the built environment especially in the east where we're not the first ones on site so another example is work in the Daisy Field drainage area which is a highly urban drainage area in Boston right around the Jamaica Plains area and it's about a 70-acre, highly urbanized area. We were asked originally during this project to find retrofit opportunity. So again, we did the feasibility assessment first using GIS and a bunch of sorting GIS tools much like we still do and then we coupled that with on-the-ground survey and detailed investigations on site to identify locations and what you're seeing in this map is all our retrofit opportunities that we identified.

As we started to work with these examples of things that we could do we quickly kind of got pushed into I guess a corner of not the space that was available that we could do things but the space that was available that we could easily implement our objectives and I don't think that this is a unique experience in fact, in all of my retrofit experience this is more often what happens- we come up with ideas we model we optimize we identify locations and then there are various reasons why we cannot implement there. It could be as in this case difficulty generating maintenance easements or getting waivers to work on private property, it could be old unknown infrastructure like 40,000 square foot underground sand filters, or the list goes on and on of things that occur and happen that sort of back us in like I said into the proverbial corner where we're not doing things where we might have modeled or optimized but we're doing things where we can, however we can, when we can and that's really the mantra of the retrofit era. Fortunately, we have tools and Region One has really it's always a pleasure to come back to Region ne if I travel outside of it because it feels so promising you know what the work that we have to do is great but the tools that we have and the, you know, it just feels like we can make progress.

So again, this this happens oftentimes when we even if we have great GIS data when we do our detailed on the ground surveys, we find it's different in this case with the same example it's six and a half feet different in the horizontal and the vertical dimensions. That's very difficult to kind of, you know figure, out if you're already way down the design paradigm so we really need to, that's where the importance of this manual and these guidance's really come into play and in this case despite all that feasibility assessment and investigations that we previously done we were stuck in the field and we were actually able to use these tools and adapt this site to manage storm water meet water quality goals and do it while maintaining the existing uses and this is all important because think about all the competing interests that

you have. There's no way that we were going to interrupt or change the use of this instead you know historic park, part of the emerald necklace in Boston so we needed to maintain that utility but we also were able to develop it in a way where we could meet water quality goals, save money, and still keep all these uses. And these methods and these details are documented and again operationalized in this manual.

So in this case we used an underground gravel filter and we were able to size that using the performance curves as a design tool and that's the big difference here. We've all hopefully seen and understood the utility of these performance curves that are in Appendix F of the Mass Permit and the New Hampshire Permit, the MS4 Permit and are quickly being implemented in other regulatory compliance efforts such as MassDOT and Rhode Island DOT and in Lake Champlain. These large efforts are all utilizing the basic foundational elements which are these performance curves and we're using them in a way not only to get credit but actually design systems when we get backed into this corner as inevitably happens in this retrofit approach so when we're working in the built environment and we have a small area that we can never install a conventionally sized or event based size system using the one-inch water quality volume we're using these tools to do again, what we can, where we can, how we can.

These efforts which I would call opportunistic planning efforts are all embodied in chapter two of the manual also in chapter two did I skip over something? oh the other point I wanted to make here with this is the fact that we saved over two million dollars so you know this is a huge, useful application of as we have this common denominator where we're accessing the performance curves and we're interpreting our design from we also get access to some of the economic tools that we have to help develop these systems so in this case we can meet the 62% phosphorus removal criteria that's in the Charles and save over 2 million dollars. This is huge and this is very unique to the northeast I think, working in other areas Philadelphia has done a lot of work, New York has done a lot of work, New York City, Washington has done a lot of work, Kansas City; and the price tags on a lot of these, granted this is ultra-urban areas, but the price tags on these we're looking in the New England area to drop a zero off of it so if it costs 250,000 to 350,000 dollars per green acre in New York and Philadelphia we're looking at cost more around 25 to 35 thousand per green acre and that's not everywhere obviously in ultra-urban Boston it's going to be more expensive but we're using these tools to meet water quality targets and also develop something that's economically feasible as well.

So this is a really all-encompassing. I mentioned chapter two that's where we outline this opportunistic approach and there's also a planning approach that really the DOTs, MassDOT and Rhode Island DOT have been implementing for their regulatory compliance issues and you can develop plans and you can use these tools embodied in this manual to develop small scale controls to meet these water quality targets and you can do it in a planned fashion.

Another idea of a planning approach is what the city of Arlington is doing. Wayne Chouinard who's the engineer there and also an EPA environmental merit award winner has developed this conceptual design of a subsurface infiltration trench that he felt that he could replicate throughout a large area of the city or the town and it started off just developing this template and then implementing this in 11 different areas through an NRD grant.

These were on the tune of about twenty-five hundred dollars each, more recently it's gone up about a thousand dollars these are about thirty-five hundred dollars each now, but Wayne figured out a way to get this in again where he could, how he could, whenever he could, in the built environment and do it in a cost-effective way. He has given presentations since and has really become a model for how to do this in a planned strategic fashion that capitalizes and reduces the cost of these particular retrofits so as Ian was saying earlier this morning too this is truly innovative and something that can be replicated throughout the area.

So much so that the in cooperation with the Mystic River Watershed association, they've taken this pilot project which was originally 11 trenches and have brought it to scale and gotten funding from MassDEP

and other funding association areas to do up to 360 trenches throughout the area. So this is really operationalizing a pilot scale effort and bringing it to a large scale effort so we're really going to keep our eye on this progress today, I think it's ongoing.

And this is all again entrenched and engendered within the retrofit manual so chapter three talks about credits using these performance curves that also back into design which is more chapter four and chapter five and we can also intersect these other cost parameters and while we're doing this using common denominators throughout the region we get access to the new emerging science, so as we improve the curves, as we improve particularly non-structural BMPs we get access to it because we're all tracking the information in a similar fashion. We've recently developed bacteria curves and those are accessible now too using these common approaches that we're looking to operationalize throughout the region so it's a really exciting and hopefully groundbreaking way of ushering in this new era of implementation.

So I want to briefly talk about chapters four and five which talk more about the foundational elements of what we traditionally have called Best Management Practices now we call Stormwater Control Measures. I'm not exactly sure why that happens, but this example is an area in Durham New Hampshire where we've worked and it was an existing residential, medium-density residential neighborhood of about 10.4 acres all draining to the Oyster River, which is impaired for nitrogen, and this drainage area basically had no treatment.

The discharge point was actually 10.4 acres of about 30 percent impervious can generate a lot of erosive flow as you likely can imagine and this is what that outfall looked like and mind you that's a 20-foot length of corrugated metal pipe just hanging out and there's no design that I've seen that leave pipes hanging. So yeah, I looked at this as kind of an erosion pin this is evidence of ongoing erosion over time. As I did the calculation on using the universal soil loss equations this came out to about 300 cubic yards of sediment that had been mobilized out of this trench and just to give you an idea of what that looks like, that's about I think about 30 dump trucks just over time dumping water right into the Oyster River or sorry sediment right into the Oyster River. So we use these elements and we refer to them as unit operations and unit processes these are the foundational kind of legos of the other water utilities like drinking water and wastewater now being applied to stormwater because these unit operations and unit processes are very predictive as we assemble them kind of like legos they're very predictive of ultimate performance so we can kind of work back from the issues in our receiving water and link these unit operations and unit processes together to address the areas of concern in a setting that's much smaller than what we would conventionally size and we're doing this I guess I would call this the hydrological Hippocratic Oath there's no way that we're going to conventionally size anything here but we're going to do what we can how we can because it's going to fit within this area that has been conveniently excavated for us by nature and we're going to do it such as to improve the existing condition; so we might not meet all our targets as if this was a new development but from a retrofit perspective we're going to improve the area and we're going to get the type of treatment that we can.

And just to highlight another thing that Dr. Cash had said about the he mentioned the win-win-win and this is a subsurface gravel wetland installation that really embodied this win-win-win because we were able to reduce dissolved nutrient concentrations here we were able to eliminate what had become a yard waste disposal issue and we're able to prevent local, this 300 cubic yards of localized erosion and sediment mobilization that was already impairing the receiving water and we were able to do this for about twenty two thousand dollars. This looks on the surface uh so to the left is the newly constructed system and it I agree it looks like a bunch of riffraff it's a little bit more sophisticated than that on the right you see the existing conditions as it existed I believe just two weeks ago and you can see sedimentation happening here so we have the surface pathway over what is now kind of turning into an emergent by retention system and we have the subsurface pathway that is going through a gravel, a saturated gravel layer, that's doing denitrification for us and this design isn't something we pulled out of a textbook it's we linked these unit operations and unit processes together in order to address a local need and get a win-win-win.

So again, the fundamentals here are really embodied in chapter four and chapter five where we cover these tools and we cover these guidances as a way to hopefully inspire a new era of creativity and stormwater implementation.

Because we're looking at this in the same fashion with the same common denominator, we get access to the power of this rich research and these rich tools that have been developed and implemented in the region. We get access to the economics and I know it's not going to be the same for everybody, but it's set up in such a way that you know you can add multipliers if you're say installing something in a urban highway environment where you need police detail and you need extra precautions; you can downscale it also if you're doing it in at this inevitable outfall where we don't have a lot of properties to protect we don't have traffic patterns, we have you know a hole that was already excavated for us and we have a plan that was linked up to provide this win-win-win that we were after and now we have access to these tracking and accounting tools that can kind of ground it in the latest and greatest science. I'm really happy that the science is rapidly changing, that's an exciting frontier to be on the merge of and as long as we're doing this in a similar fashion now, we get access to new innovations that come down the road.

Lastly, I just wanted to end with kind of other things that this address that kind of honors the flexible nature that retrofits and installing these again Hippocratic Oath types of installations within the built environment. We've already talked about the sizing flexibility but we also have depth of groundwater and bedrock separation flexibility built in and this is largely been something that we've come up with our own alteration of train program to get at areas that we just couldn't feasibly get three feet of separation but we did in a way that honored protection of groundwater and still allowed us to do, to get multiple benefits from these retrofit opportunities. Same thing with soils we're looking at all soils not just hydrologic soils A and B as being able to generate positive controls and we're looking at pre-treatment not as a volumetrically sized forebay, but as a flexible suite of pre-treatment controls with the final goal of just providing a viable and accessible long-term operation and maintenance access.

So these all feed into these larger network and SNEP context and priorities of building capacity, increasing the availability, solutions inspiring innovation, and demonstrating scaled approaches that can be widespread not only throughout the region, throughout the SNEP program area, but throughout the region.

And then I will end with thanking the large team that we had and VHB and the SNEP network for funding this also Elizabeth Scott and Kimberly Groff who were our liaisons for Mass and Rhode Island but this really extensive technical advisory committee that tapped into the just a wealth of experience from MassDEP, MassDOT, RIDEM, RIDOT and we even expanded throughout New England into Vermont and Connecticut understanding that they were involved in updated manual processes as well and we wanted to make sure that this met their needs. So thank you for your time, I will right now drop some links into the chat which I had hoped to do earlier. First I'll stop sharing and then we might have three minutes for questions and while we take questions I'll drop these links in the chat that provides some resources that we have today.

Adam: Excellent thank you so much. [Music] sorry that was on my end, but thank you so much for that Jamie. I would now like to open it up for questions, please do utilize the chat function and I'm happy to read your question aloud if we have any questions for Dr. Houle. Actually I have one off the bat that I'll ask while people are typing their questions in, but when or where can people access this manual or if it isn't available yet when might we expect to be able to access it?

James: Yeah, great question and this is the one regret. I mean we are, it is finished and we're working on the formatting now, the non 508 compliant manual is expected to be available in at the end of June and we're targeting mid-July for the release of the five-way compliant manual but until then we have these fact sheets explaining the tools and we're really operationalized tools that already exist and so those are embodied within the performance curves and we have various tools on our website that you can access now and start to do this design process and also I put in the SNEP network training that we're doing the

stormwater planning series and that essentially was modeled after making a curriculum out of the retrofit manual so we've already gone through that once I believe the intention is next year to go through it again or later this year and so we're actually providing technical assistance and training on these methods as well.

Adam: Excellent, thank you so much and there is one more question that we can address before we go to the breakouts, it's that you know costs per pound are enormous so are there any examples of the total bill or what the total bill will be to meet a target for a watershed or a town?

James: Yeah well costs per pound of phosphorus are large and generally they always are for nitrogen. I'm forgetting what that actual cost was but you know these costs are enormous, I mean we've heard costs upwards of a hundred thousand dollars per pound of nitrogen removed and again we're bringing that down and I think it's too early to tell. I think innovations that are inspired from folks like Wayne Chouinard are really going to revolutionize this so I'd hesitate to lock into a number now where we're really targeting this common denominator tracking system such that we can more accurately track this over time but yeah, I would say and good to see you as well Paul or hear from you, I would say we're in the beginning of this so the hope is where we're starting is not where we're going to end.

Adam: Excellent thank you and one more question briefly if a tribe or town is interested in using this manual, is there someone that they can call on to explain the approaches and or be available to answer questions?

James: Yes, absolutely I think we're going to as we roll this out this is the first of many kinds of showcases of this and again, we have that technical assistance available through the SNEP network that you can access and hopefully we'll be rolling this out again soon where you can actually be part of this stormwater training series where we essentially guide you through this whole process and we're just utilizing all the tools that are embodied in this manual that the region has developed.

Adam: Excellent thank you again Jamie and thanks everyone for your questions, I'm sorry we weren't able to cover all of them.