

Rukmini

Hey everybody, this is Rukmini from NRPA and you're listening to the Guardians of Greenspaces podcast, the show that explores water conservation from a park-and-recreation maintenance lens.

Today we're talking about green stormwater infrastructure with Neal Wisenbaker from Raleigh and Blue Baldwin and Greg Jackson from Tucson. We'll discuss how good cross departmental collaboration can be a solution to green infrastructure maintenance challenges.

Could you all introduce yourselves briefly for our listeners?

Neal Wisenbaker

My name is Neal Wisenbaker and I'm the Green Stormwater Infrastructure Operations Supervisor for the City of Raleigh.

Blue Baldwin

And I'm Blue Baldwin. I manage the Storm to Shade program, which is the City of Tucson's Green Stormwater Infrastructure program.

Greg Jackson

I'm Greg Jackson, the Deputy Director for Tucson Parks and Recreation Department.

Rukmini

Awesome, thank you all for being here with us. I want to start at the beginning here and just ask you all to give some background on what green infrastructure looks like, where you're at. So the types of green infrastructure that you're implementing and sort of the lay of the land there. And then we can go from there.

Neal Wisenbaker

Sure. I work in Raleigh, North Carolina, and Raleigh is the third fastest growing city in the nation. We receive about 46 inches of rain each year. And with the increased amount of impervious surface, the citizens of Raleigh really sought the expanded use of green stormwater infrastructure, such as bioretention, green roofs, water harvesting, constructed wetlands to replace our traditional gray stormwater infrastructure such as concrete pipes and gutters.

In addition, GSI are landscape enhancements that improve water quality while providing additional benefits such as wildlife habitat and community aesthetics. They also reduce urban heat and increase citizen participation in the landscape.

So in 2019, our city council requested the stormwater management advisory commission to develop a GSI plan for the city. And this plan was adopted into the city of Raleigh strategic plan. And in 2023, the city adopted the GSI policy that requires all city projects to evaluate GSI. In 2025, that's this year, we created the Green Stormwater Infrastructure Maintenance Team, which is a collaboration between Parks Maintenance and Natural Resources and the Stormwater Management Division.

Blue Baldwin

So the primary driver for GSI in Tucson is water conservation and urban heat mitigation. Tucson historically received 11 to 12 inches of precipitation a year, but these days it's more along the lines of eight to nine inches of precipitation.

So we are very serious about water conservation, both within Tucson water and across all the different municipalities in our region. so green stormwater infrastructure is a way of creating green space and landscapes in the urban core that are able to rely on stormwater alone as the primary irrigation benefit because they incorporate only native Sonoran desert plants.

Those GSI projects also are urban heat mitigation in that every little plant, every tree is providing shade and acting like an evaporative cooler through the process of photosynthesis. As plants photosynthesize, they release moisture from their leaves and that moisture helps to cool the surrounding environment.

So unlike many cities throughout the US and North America, our drivers for green stormwater infrastructure are water conservation and urban heat mitigation rather than regulatory requirements around water quality. That also kind of allows us a lot more freedom in what GSI looks like and the kinds of projects that we can do because we don't have those stringent regulatory requirements around water quality. And so GSI in Tucson,

looks like areas of depressed landscape that have an inlet, which is often a cut in a curb or just a flush surface that allows stormwater from an adjacent impervious surface like a street or a parking lot.

And then that stormwater can flow into a lower vegetated basin, again, full of a variety of plants from understory to mid-level to canopy level. And then there is also a designed outlet or overflow. And these can be small features from minimum like four to five feet in length to extremely long meandering swales with a series of berms and basins to allow stormwater to convey across a feature.

And so we see these in the form of traffic circles and chicanes in the case of streets. But then in parks, we are doing a lot of conversion from turf area, irrigated turf area, to green stormwater infrastructure features that need a lot less water than those turf areas and also require a lot less maintenance than those turf areas.

Rukmini

Awesome. So I want to ask you all something that we've heard when we've talked to other agencies about green infrastructure, water conservation, coming at it specifically from the maintenance lens is that often there are multiple groups that are maintaining, responsible for maintaining green stormwater infrastructure. And so I want to ask you all, as you're giving us some context about what green infrastructure looks like where you're at, what partnerships are necessary in order to create long lasting sustainable green infrastructure projects.

Neal Wisenbaker

Our stormwater management division in the city collaborates with other departments in green stormwater infrastructure. So that includes parks, recreation and culture resources, our transportation, housing and neighborhoods, public utilities, all sorts of different departments within the city of Raleigh.

And our stormwater management division operates like the center of that hub for all things GreenStorm Water infrastructure. In addition, they also work with, we also work with nonprofit organizations and other social enterprises to do parks maintenance, river cleanups, and other kinds of workday type volunteer activities. And we're even starting to

work with high schools to do certifications in GreenStorm Water infrastructure so that they have a pathway towards employment in this field.

Greg Jackson

So in Tucson, Tucson Water is really the hub for our GSI program. Tucson Water has a fee on the water bill. So they're the real funding mechanism for us. And then we're really the way here in parks to implement the programs -- one of their ways of implementing. They can implement in streets, they can do parks.

And we also work with the Pima County Regional Flight Control District. So a county agency who has a funding source to implement programs as well. Parks are an obvious place to retain these these waters as opposed to trying to do some public, other public places. So parks are just a good location for the projects to take place.

Blue Baldwin

And adding to what Greg said, as he described, Tucson Water is the hub of the Green Storm Water Infrastructure Program because we do have a dedicated source of funding through folks' water bills, which is delivered in the form of a small fee on a water bill. But we work across departments internally within the city. So a lot of work and collaboration with parks and other city departments.

So we rely on external partners outside of the city to do the maintenance of green infrastructure within the city. So partners like Tucson Clean and Beautiful, which is an environmental advocacy group in Tucson, partners like Primavera Works, which is a pathways to employment organization, and then additional landscaping contracting firms throughout the city. So those are really important partnerships to have.

Rukmini

So I know we wanted to focus on partnerships because we know that strong effective partnerships can be a solution to some of the maintenance challenges that we've heard about within green infrastructure. And so I wanted to back up a little bit and ask you all about the big picture here around what are the challenges that are faced when you're trying to maintain green stormwater infrastructure? What does that look like where you are and how have you kind of addressed that?

Neal Wisenbaker

Our immediate challenge in Raleigh, North Carolina was that we didn't have a good grip on how much maintenance Green Storm Water infrastructure was going to require. And we had devices going into the ground with no real sense of how they would be taken care of in the future. So we really tried to deal with that problem.

And we've done a number of things. One was to create a collaborative green stormwater infrastructure maintenance crew, which is what I do. And another solution was to hire contractors when necessary. So we have done that as well. But beyond that, we've also done a lot of collaboration.

So for example, we would do a design charrette between the stormwater division and the parks department and the transportation department to look at design details and ask, you know, how could we better design this GSI for maintenance moving forward? So that might be everything from plant selection to water dissipation and that kind of thing.

So as we started working together, we realized that there were opportunities and challenges. Some of the challenges, which were also opportunities, were like using the right language so that everybody was on the same page. Maybe our work order systems didn't jive together. So getting those to work together was a lot of the background work that we had to do.

And in addition, we were able to leverage dollars from the stormwater division, from that fee-braced, enterprise fund into parks maintenance. And so that was really helpful for enhancing our park system as well.

Greg Jackson

In Tucson, one the things we found out really early was trying to retrofit GSI basins into old parks was really difficult because we didn't build parks 30, 40, 50 years ago to capture water. So trying to go back and put these GSI basins in existing parks was much more expensive. So we quickly learned as we're getting into new design of parks, we're incorporated into the design early and that makes it much easier, much more affordable.

From a maintenance perspective, it's not your typical maintenance. It's not your typical look like you see in a lot of parks. You a lot of parks have a very well manicured look to them. GSA basins are going to have much more of natural look to them. So helping our park

staff understand that we don't maintain those basins because I'm going to let Blue talk about how she maintains the basins.

Tucson Water actually provides the funding to maintain these basins. So for our park staff, we're trying to educate them to leave the basins alone, don't spray anything in there, don't trim anything in there, and then trying to communicate to the community that these kind of more natural-look basins are a good look in the park and they don't think that they're unmaintained and not taken care of. So that's just a challenge we face with both staff and the community.

Blue Baldwin

Yeah, and dovetailing into what Greg said, the proper maintenance practices for GSI vary greatly from typical maintenance practices. And we recognized immediately that we were going to need to establish a GSI maintenance protocol that could be agreed upon and adopted across the city of Tucson because we see GSI in parks and we see it in streets and all of these different departments have their own maintenance folks who actually are the ones on the ground touching this stuff. And so we were fortunate enough to be able to partner with the University of Arizona to do a very inclusive and extensive vetting of proper maintenance practices.

And out of that, we were able to crystallize what we call the GSI maintenance protocol, which we actually now have in the form of a printed booklet. It travels around in hopefully most city of Tucson maintenance folks trucks. It is tear proof and coffee proof. And it's really a quick and simple guide to proper maintenance practices for GSI, which really comes down to maintaining landscape for the health of the landscape above all else so that the landscape can provide all of those wonderful benefits that GSI provides barring only health and human safety. So things like pruning for vehicle clearance, pedestrian clearance, site visibility, etc.

And as Greg mentioned, the look of GSI landscapes is much more naturalistic. So, it has taken some training of our internal staff people to teach them to recognize Green Stormwater infrastructure landscapes so that they know that these are areas that get maintained differently from the rest of a typical parks landscape. So we created a protocol for the best maintenance practices for GSI. And that's in the form of this handy dandy little pocket guide.

But then we also created curriculum for training. And we deliver that training through our the University of Arizona's ag extension, which is a close partner of ours, Tucson water, which is where the storm to shade program is based, also funds that program through the

University of Arizona to provide landscape maintenance trainings to all comers. So we developed a training that is specifically geared toward city of Tucson maintenance folks, anybody who might touch landscape at any time. We developed that so that it's a very consolidated and very information packed training that can be knocked out in a day, so people aren't missing too much time from their daily jobs. But that training is also provided to anyone, any member of the public who's interested in honing skill sets around GSI. And it's also available in a more long and extended form.

Neal Wisenbaker

So in Raleigh, North Carolina, we realize that there's a variety of maintenance teams that work on a GSI device at any given time. There could be a parks district crew that does mowing and trash pickup around the device. There could be a contractor that comes in and does aquatic weed maintenance, for example, maybe our transportation department will come in and flush pipes for us if they get clogged. And our stormwater division comes in and does quarterly and annual inspections on these devices as well.

So there's a variety of maintenance teams that work on any one GSI device. And we recognized that early on. And we designed a maintenance agreement that defines the tasks that need to be done on any given GSI device, assigns those tasks to a responsible party and explains what the frequency of those tasks is on that device. Defines what the frequency of the tasks are on that device. And that's a maintenance plan that then we then incorporate into a memorandum of understanding with the GreenStorm Water Infrastructure Device and a service level agreement with our stormwater division.

These maintenance agreements are useful for onboarding new staff, such as if we get a new supervisor in parks, there's a lot of turnover a lot of times. And so it can be really helpful for understanding who does what on these devices.

Greg Jackson

The one thing I would add to this is one tool we have used to help staff identify GSI basins is we use Cartograph as our asset management system. So each of our employees has a cell phone out in the field which is listing tasks for them to do. They can actually pull up a map of the park and we have the GSI basins mapped out so that you can look at that basin and see, that's GSI, we don't need to maintain it. Blue's team is going to take care of that.

Blue Baldwin

Right. And so to dovetail on that, because we do not rely on our park staff to maintain those areas and we rely on contractors, one of the additional clarifying tools in addition to those cartograph maps that Greg referred to that park staff have is-- we also create GIS based maps of every park and where the GSI features are within those as a tool. And then we've also developed signage.

So on all of our GSI features that are in parks or in streets, we have created little emblems that go on the curb surrounding the GSI that say this site is maintained by Storm to Shade. And then there's a phone number that anybody can call and they will reach us if they have any questions. So that's really helpful just to have that visual cue to anybody who might be doing maintenance in the area so that can it kind of catches their eye and they can stop and say wait this is not something I have to maintain this is maintained by storm to shade.

Another piece that is really helpful for making sure everybody who works in parks is updated and informed about GSI is when we're building new projects in parks, we really try to involve the current staff, those groundskeepers, irrigation managers, all those park staff who are in the park and seeing it regularly, so that they know where the GSI features are, what their purpose is, and how they work. And then they have a relationship with that space and understand it. And then that really facilitates much better communication between those staff and ourselves, which is so important because they're the ones who often will spot something that needs to be repaired or restored if something's going on.

Neal Wisenbaker

Our stormwater division has engaged with maintenance staff in parks and transportation, for example, to really inform the design of GSI devices in terms of choosing the right plant and for the right place, for example. But also we've done things like created working groups that to tour GSI devices after they're built to discuss what's working and what's not working. And then we can even make small adjustments to those devices as a group.

And, you know, we may expand a planting bed by four feet to minimize rutting from a lawnmower, or we may, maybe the wrong species of plant was used and it didn't survive very well. So we might replace that or fill those holes. And so that sort of follow on adaptive maintenance is really helpful for the success of the GSI project.

Blue Baldwin

And I would love to hop onto that to say something that we have seen is that when maintenance informs design and there's this continuous feedback loop, then projects get designed for maintenance and that eases the burden of maintenance for everyone. a couple of examples that we've seen of that are... In early days, sediment traps were often entirely rocked areas, sort of like a four to six inch riprap area right where water enters the feature. And those are extremely difficult to maintain. You get weeds growing up in them and it's really hard to get the weeds out without pulling all of the rock out. If they get filled with sediment, it's really hard to scrape that sediment out over that rock surface.

And so we've adapted a sediment trap so that now they're just bare soil lined with riprap. So it creates an area where water enters the feature, gets slowed down by a surrounding circle of rock, and then can overflow into the rest of the feature. Another thing that we've seen is landscape cloth is typically used in a lot of different landscapes underneath rock and gravel. But when water is flowing over those areas, as it does with GSI, there's often such an erosion of material that the landscaping cloth becomes really visible, rocks fall out and are not well placed. And so we've taken landscaping cloth out of a lot of our plans for GSI projects.

Greg Jackson

I want to touch on one thing from a maintenance standpoint. I know I've worked in a lot of departments in my career all across the U.S. and like nobody has enough maintenance staff to do things at the level we would like to do things. So one of the beauties of this program is, know, Blue's funding the maintenance of these areas. So if I can take two or three or four acres that used to be maintained turf, now it becomes a GSI basin. That's two or three or four acres that our staff don't have to maintain.

So I can use that time and reallocate it to other things in the park system. This can reduce some of the demand on staff. There's always more things for us to pick up on. But it's great for us that Blue's funding the maintenance of these basins in the parks. And we're not trying to add to our workload. We're actually taking off our workload.

Blue Baldwin

And then the other benefit that comes from reducing turf in parks and converting it into GSI is we're saving water that would otherwise have been needed to keep that turf looking green and lush. And instead, we're installing a landscape that can survive purely on whatever rainwater and stormwater flows into it.

Rukmini

That's a perfect segue into what I wanted to ask you as we move into the last section here. You all have partners that you are collaborating with. You've talked about how that eases the maintenance load. And then you've talked about the types of collaboration, ways you've made this work. And so I wanted to ask you, what does the collaboration and the focus on maintenance together offer in terms of long-term success on these projects?

Greg Jackson

Two things come to mind for me. One of the things we looked at really early on is do we put in really inexpensive irrigation systems to get our plant material through the first few years or do we hand water it? And every organization has got to figure that piece out separately, but it can cost you a fair amount of money to put irrigation in and our long-term goal is to not have to need irrigation. So just something to think through.

And then one of the things we did, you we went back to our very first big GSI project in a park and we went back a year later and really brought all the people together that were involved: Blue's team and Storm to Shade, we brought in the landscape architect, the design, the contractor, our maintenance folks to really go back and revisit those basins and talk through what worked well, what did not work well as we continue to design these going forward, what change we make. So going back and learning from those mistakes or understanding what worked really well just helps you set you up for more success going forward.

Blue Baldwin

Yeah, another example was the tree selection that we had. So one of the main pieces of this really big, very first GSI project that we did in a park was to convert the parking lot into a stormwater harvesting parking lot rather than having just elevated medians and elevated surroundings, we cut those curbs, depress the landscape so that water from all of that impervious surface throughout the parking lot could flow into the vegetated areas. And so we were really excited about planting big shade trees in the parking lot because the Tucson parking lot in the summertime is insanely hot. And so we're really crazy about being able to add shade.

We chose a tree that proved to be a very inappropriate tree for a parking lot just because of the way it's naturally shaped. It's a native desert tree, the Mesquite tree, they come in a variety of types, but they want to grow very wide and be multi-trunked and this created a constant need for maintenance because branches were growing so far out into parking spaces people couldn't open their doors without getting whapped in the face by a branch.

And so going back to that project and seeing that these trees were requiring so much maintenance in terms of pruning and we really should have chosen a different species was very informative and we have applied that to our projects in parking lots going forward.

Neal Wisenbaker

One example that struck me was that when we did review of GSI devices with Parks Maintenance staff, we were looking at those rock dissipator pads as well, because they are a high maintenance feature of GSI. And the maintenance crew, the Parks District crew on that site was like, just take the rock out.

We can leave it turf and we can mow that turf on a regular interval. Debris that might accumulate in that turf, we can then just chop up with the mower and it's a whole lot less maintenance for everybody. And, you know, we're not talking trash, we're talking leaves and sticks and that kind of thing. And so it was a real easy solution to a problem that a lot of engineers had scratched their head at for a long time. And so I really appreciated their input to create those turf dissipator pads.

I think to create a long-term sustainable green stormwater infrastructure program, we're developing a lot of model sites right now, but I think in the future we'll probably really start to lean more on the community and participation in the maintenance of those sites. And so that the community is actually stewarding the landscape towards their ends and I'm hoping that's the direction we're going in in the future.

Blue Baldwin

I would love to add that I think something that I've observed in traveling to other cities and learning about GSI in those places is that there's so much excitement about and around building new GSI. The multiple benefits of GSI are very well documented at this point. so there is a lot of attention on and funding for building new GSI projects.

But the redheaded stepchild is always the maintenance piece. And without the maintenance piece in place, GSI features simply over time fail to be functional. And that can cause some real problems, especially in communities that may not have the resources or the connections to reach out to city staff and ask for care and attention to be an investment to be made in these. And so when the storm to shade program first came into existence, we performed an asset inventory to try to identify all of the existing GSI throughout the city that had been built using city funding over the past two decades or so.

And we discovered a lot that due to lack of maintenance had been literally destroyed in terms of its GSI functionality. Folks had taken it upon themselves to brick in a traffic circle that had become overgrown with weeds or just to chop down and pull out all of the plants in certain features because they were eyesores at the very least and in many cases were actually harboring invasive species like buffelgrass, which we are in constant battle with to keep at bay in Tucson.

And so when the Storm to Shade program came into existence, one of its primary mandates was to perform maintenance on existing legacy GSI and also any new GSI that we built in streets, in parks, in any city of Tucson property. And that has been crucial to the success of the program, especially in gaining community buy-in to building GSI because oftentimes a city will swoop in and deliver a project and then once the project is complete, there's sort of a walking away and then the project is left in the community and the community may or may not have the resources to be able to care for it. But when you have a built-in maintenance program, with a dedicated source of funding so that that can be a long-term commitment, then the community observes that the city is coming back over and over again and tending to this resource that it's created so that it can provide the benefits to the community that were intended in the first place.

Greg Jackson

Something you might want to add or talk to is the frequency of maintenance is a lot less than a lot of other types of assets. You don't need to maintain a basin every week. You don't need to maintain it every couple weeks. It's Once a quarter every three or four months.

Blue Baldwin

Right, right, exactly. So our maintenance, our preventative maintenance schedule is approximately quarterly. We're able to add work as needed, but because GSI is based on nature sort of having the opportunity to do its thing, those GSI systems are very low

maintenance. They require a lot less care and feeding than most other landscapes do throughout the city.

Neal Wisenbaker

Yep. I'm involved with a lot of plan reviews, specifying a plan for a GSI and looking at it from a perspective of maintenance and helping to guide the development of GSI. And it seems like we put a lot of effort into these efforts up front, maybe several years of effort with designers and consultants to building a GSI. But at the end of the day, after you worked for all that time, you've arrived at, and you get it in the ground and you've cut the ribbon. You've arrived at day one of the life cycle of that device.

And you've got the rest of its life ahead of you. And you have to steward that GSI device like a child basically and bring it into the world. And so GSI maintenance, as Blue said, is an extremely important aspect to the development of GSI. I think we have a lot to learn. And I think we're really developing an interesting body of experience with GSI maintenance.

Rukmini

Thank you, Neal, Blue, and Greg, for sharing your expertise on green stormwater infrastructure and maintenance. Check out our other episodes on water conservation tools, including green infrastructure pt 2 and community engagement, on Guardians of Greenspaces. We appreciate everyone listening and reminder— answer our key question and you could win a \$50 NRPA store gift card!

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