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Paul Thies: Few things are more important to sustaining life than water and therefore all water has value. It requires a complex operational system to process and treat wastewater and to provide clean drinking water while simultaneously promoting environmental sustainability, a tough challenge that demands the best people, processes, and technology. At Jacobs, we refer to it as Intelligent O&M or operation and management, bringing together our deep water domain expertise with the latest in AI-empowered tools.

Hello, I'm your host, Paul Thies. On this episode of *If/When*, we explored Intelligent O&M with two experts from Jacobs, Dr. Jennifer Baldwin Digital OneWater Strategic Growth Lead, and Joshua Registe, Data scientist and Environmental Engineer. We discussed the concept of OneWater and how digital tools enable greater support for water management facilities and professionals, as well as the positive environmental impacts that digitally enabled water operations can achieve.

Jen and Josh, thank you so much. I'm looking forward to talking with you today about Intelligent O&M technology and how it folds into this concept of Digital OneWater, which is something that Jacobs has really gotten behind. It's really fascinating to

Paul: As part of that, and I think it's really fascinating because just you dropped that 10% figure and that's just amazing to me. I know that Jacobs is very bullish on sustainability and positive clement efforts and obviously you can't get more life essential than water. Oxygen and water, that's pretty much the big two, you start there. Jen, can you tell us a little bit about how Jacob's water-focused solutions such as Aqua DNA and Intelligent O&M, how do those assist in water sustainability efforts?

Jennifer: It's about being able to be more efficient in what we're doing. I look at it as sustainability in terms of our operations, not necessarily environmentally but as well as with people. I think one of the big issues I see digital OneWater helping with, and Aqua DNA and Intelligent O&M certainly are two big parts of that is we're able to almost use data as a surrogate for that operator that's been there for 30 years and who just retired.

He had a log book or a spreadsheet or he had things in his head that he just knew, "Hey, I need to turn this valve here. I need to use this level set point there." When that human knowledge is gone, we can use the data, the historic data, and I think Josh will be able to speak to that a little bit as well to then make decisions that help us train the next operator, which to me is huge part of sustainability.

If we don't have operators that stay on staff we can't be sustainable and keep our water safe for the public. To me, people is a huge part of that. I think that's where a lot of our digital approaches help is to just almost give that little assist to the operators so they can do their job more efficiently.

Then another piece is we're looking at what we're calling right now hybrid optimizer, looking for a better name for all of it, but is using a mechanistic model, so our process model to then help us meet environmental and sustainability goals. We may not want to spend thousands of dollars or tens of thousands of dollars in some of these sensors that you may want to have.

If we have a good process model and we have real-time data coming in from the sensors we have, we can use that process model to estimate our nitrous oxide emissions, for instance, and then that will help us to meet those environmental and sustainability goals as well. It's a two-pronged approach, I would say.

Paul: Then Joshua, now you're a lead data scientist and you were, I understand, one of the key architects or fundamental players in the rollout of the Intelligent O&M product for Jacobs which I alluded to earlier uses Palantir to the Palantir AI technology to help expand our offering there. Can you tell us a little bit from where you sit and having experience with this technology, what are two to three of the top benefits that Intelligent O&M provides to clients?

Joshua: That's a good question, Paul. The potential for optimizing treatment plants through machine learning and data science, I think is really enormous. Jen alluded to this earlier, we have so much data being collected from different sensors or monitoring systems, our laboratory information management systems and using data science tech technologies that we've developed, through Intelligent O&M has helped us to really uncover valuable insight and patterns. The same could be done for a lot of our clients.

for ammonia or nitrates or total nitrogen while minimizing aeration. We're seeing anywhere from 5% to 20% reduction in power compared to pre-deployment.

One of the other interesting things about this power case studies is how scalable these solutions are. We've configured it and this kind of ties into the later half of your question with best demonstrated practices, but we've generalized portions of our workflow that allow us to scale and iterate pretty quickly from site to site. Of course, there are some nuances between facilities whether that be plant configuration or types of sensors or the size of the data, that also have to be taken into account, so having the flexibility to fine tune those differences allow us to capture site-specific benefits as well.

For the second application, the disinfection one I like this one a lot because this is a nuanced problem that can have a lot of data limitations. There's always the talk

wastewater, because truthfully I think operate a few more wastewater facilities than we do water facilities. It's definitely on our roadmap I would say.

In similar principles I think in the clean water space we tend to use a little bit different terminology, but we'll still be using that smarter approach where we can still, I think see some energy savings. Also, see some potential benefits of a lot of times in water treatment and distribution, you can end up with water age problems and that can be some water quality issues. I think there are some opportunities to look at how and when we're pumping water, and look at high demand times, how do we get the water out and get fresh water out to people?

Then on conversely during low water times do we start to ramp things down a little bit more, so we can maybe look at some of the water age issues that might be out in the system. There's lots of possibilities I would say.

Paul: Let's unpack that a little bit, and my next couple of questions for both of you and Jen I'll start with you. This is about where we are going from here. Now that we're starting to deploy AI powered technology and really leveraging the data in ways that we really couldn't, or maybe, yes, I'd say we really couldn't before, because of technology limitations now we can. Let me ask you, Jen, where do you see the efforts to promote clean water and sustainability headed in the next five years or so?

Jean: This is I think one of the toughest questions we could try to answer. It's hard to have a crystal ball. I've had this discussion with a couple people. I really do feel like we're almost at the beginning of this digital revolution in water where we're so early in what we're doing, that it's I think the sky's the limit really. It's a matter of we still want to keep things in the control of humans I would say, I think there's still a little bit of fear of the machine if you will.

In the next five years it's really going to be about acceptance of our clients and our end users. If I'm drinking a glass of water, I want to have confidence that that is still good clean, good quality water. As a user of water, I want to make sure that if someone is using a digital approach that they're not compromising anything in terms of water quality.

I guess, I would say in the next five years as far as in terms of our digital approaches as well as looking sustainability, the main thing I really see to be truthful is merging some of these things. Really, I can see where Digital OneWater is going to-- we can look at our water sources with our flood model or platform, or other tools that help us to see how much water supply do we have? Where is it? How much do we have? What's it look like?

Then we can feed that into our drinking water facility, and then we can see what's coming into our collection system as well with Aqua DNA and then feed that into what's going to the treatment plant, and really operate it as almost one system. Right now, we have a lot of I would say geographical, but as well as administrative boundaries that limit how we apply OneWater or Digital OneWater. Because one city could have a storm water utility, a wastewater utility, a drinking water utility in the water resource itself, could encompass five or six municipalities or something like that.

Right now, we have a lot of limitations as far as how do we actually try to apply this. I

I think another thing that excites me a lot is the progression of language models in the AI industry. Just imagine you're an operator and you're taking care of a lot of different things that are going on at a wastewater treatment plant to ensure things are running, and you can just simply ask prompts that say based off of all the data and everything that we're ingesting and all the modeling that we have running in the background, what's the optimal dosage for the next three hours? Or what adjustments do I need to make for the next 24 hours in order to meet my compliance goals?

Then getting a detailed response that you can interact with and even visualize, I think is amazing. We're having a lot of talks about that in the Intelligent O&M space. Then in addition to the data aspect of it, there's a significant environmental benefit to these. You guys were talking about it earlier. When you think about power consumption in the US or just across the utilities, waste water treatment plants, they comprise of a significant portion of our usage and when we're optimizing 5%, 10%, 20% across our portfolios does have a significant greenhouse gas impact.

Similarly, when you're thinking about chemical usage and we're reducing the strain on chemical manufacturers or supply chain or chemical waste, that's also a significant benefit to the environment, Paul. That's very exciting to me.

Paul: No, that's amazing too. It's like you don't know what kind of waste we can avoid and not just like the financial issue but the environmental impact cost until the systems, the data is talking to each other and we're able to really literally pull out the intelligence from all this masses and masses of data. Now, Josh, you touched on it here and we talked about it a little bit earlier, but I think what I am learning is key. Again, it's the concept of socializing the humans with this technology.

It's like, "We can get really excited about these advances we're making in AI and things like that," but it doesn't mean anything if operators and owners, whatnot, decision-makers are like, don't want to use it or they're reticent about it, they don't understand it. They're slow to adopt because they see it as a barrier, whatever. Josh, from where you sit, what are some of the best methods that organizations should consider about how and when to deploy Intelligent O&M technology into their daily workflows?

Joshua: I think I want to start off by saying not to be intimidated by the idea of a digital transformation or data science or machine learning or any of those buzzwords that we hear a lot. Organizations I think they can get started by identifying some of the more quick potential wins for optimization for specific areas of interest to them, and then diagnosing the data availability and the limitations, and then start to build in

Some of the questions to ask is how do you drive success? How do you drive engagement? It's been our experience that you have to keep the operators top of mind because these valuable folks on the ground are the core of keeping our infrastructure running. It's what makes these technologies successful. Being thoughtful with the proper training and support ensures a smooth transition and it addresses all concerns and it allows the operators to actively participate in the adoption.

Ultimately, when this is deployed, everyone takes ownership. The entire team is empowered and more efficient because of that. Once all that happens, you've started to realize the benefit of achieving some of this more low-hanging fruit, and you'll be able to demonstrate return on investments and then share your success stories and then further accelerate the growth in that digital space.

Paul: Well said. I really appreciate that keeping the human front and center, being mindful of how users are going to use it or not use it, what they're looking for and how you can help encourage adoption, I think is going to be key.

Jen and Josh, thank you both so much for joining me today and helping me understand a little bit more about Digital OneWater and how we're using these amazing tools to again, take care of this life-essential resource and helping our great