[music]

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 think about this whole idea of water is just this one unitive resource and how we use digital technology to care for it and use that resource. I'm really looking forward to unpacking this with you today.

I know Jacobs is recently expanding its partnership with Palantir, the on tray into that was our Intelligent O&M product that we have deployed in concert with Palantir. It's really fascinating to see where the future of water management is going and how we're using these data tools. Anyway, thank you both so much for joining me today and I'm looking forward to our discussion.

Jennifer Baldwin: Yes, great to meet you. Thanks.

Joshua Registe: Thank you, Paul.

Paul: All right. Excellent. Jen, let me start with you. I alluded to it just a little bit but I didn't do it justice. Can you talk to us a bit about the concept of OneWater and how digital water or digitally enabled water technologies helps support the OneWater approach?

Jennifer: Our OneWater approach really starts with all water has value and it's all interconnected. We have clients that we're working with that have just reams and reams of data they've probably been collecting for years, and they just keep adding to that data they collect. What we found is they're not really using the data, they're maybe using 10% of that data. With our Digital OneWater approach, what we're saying is we can be that partner with our clients, our water clients, so to really turn that big data, as we call it, into actionable information.

To me, that's really the crux of Digital OneWater is being able to use the digital tools at our fingertips to help us better operate our facilities, our collection systems, our wastewater treatment plants, water treatment plants, whatever parts of the water cycle that may be.

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.

Just by example, we can develop predictive models that help us switch from our typical reactive style of operations to enabling something a bit more proactive in our decision-making, predicting future conditions based off of real-time data, and more importantly, controlling to that future literally allows us to design a specific future that we want on any given day as it relates to water quality or consumption. That's been very valuable.

Another benefit, Paul, is the empowerment of our treatment plant operators. The ability to make these decisions in real-time allows them to address challenges and prevent failures. More importantly, it allows them to focus on their day-to-day tasks and keeping our critical infrastructure running that doesn't involve scrubbing through loads of data to manage process optimization.

Then the last thing I'll say is because we've garnered a lot of interest in this space too, and it's pretty exciting, it's leveraging data to enhance predictive maintenance strategies. All of our plants, they have all this complex machinery, all these pumps and blowers and reactors, and valves, and ensuring the proper functionality of a lot of this stuff is crucial.

Again, analyzing our sensor data and our historical maintenance records, and our real-time staffing resources, our mechanics, our electricians, our maintenance staff, we can both identify the risks to all of our assets and also allocate the resource in an efficient way to manage those assets. We've seen a lot of engagement and interest from our clients as it relates to that as well.

Paul: That's fascinating. One of the things that I have run into in some of these discussions in terms of using these data-enabled tools, they do wonderful, wondrous things, but I think part of a challenge for clients is helping them understand how to fold this super technology into their workflow. It's like maybe you have an engineer who's been doing a certain thing a certain way for 20 years, and then suddenly this cutting-edge AI technology shows up on the scene and it's helping him or her understand how that can help them and they can fold it into their way of doing things.

I think that, like Jen, you had mentioned all this data that gets generated that's been unused here to four but this technology can help you chew through that and really use it in a way that becomes beneficial. Josh, let me ask you, as you've been working with clients rolling out Intelligent O&M, can you share with us some interesting case studies or best demonstrated practices, that have surfaced, that you've seen related to Intelligent O&M?

Joshua: Yes, sure. We have several interesting case studies at our facilities now. The acceleration with Palantir has been great for us. A ranging from polymer optimization for dewatering processes, coagulant for phosphorous removal or managing nitrogen with lower optimization or disinfection processes. I'll talk to two types of optimizations or case studies that we've done.

Power and chemical, with the power optimizations we have several models running live now. It's several facilities such as Agua Nueva and just on Arizona or Clovis California or Spokane Washington treatment plant. With these aeration optimizers, it's allowed us to manage nutrient removal across our sites, whether we're controlling

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 about we have a lot of data and a lot of it goes unused. I said that earlier but the flip side to that sometimes we don't have enough data or we don't have the right data as it relates to a specific optimization.

When you're talking about disinfection one of the main limitations might be that bacteria. Oftentimes when you're collecting that information at a plant it's a lot of zero-based data which is hard to model against it's great for operations. In addition to that bacteria data is not necessarily something that can be easily measured in real time, but in our Intelligent O&M workflows we're able to demonstrate even with these limitations that data science is very versatile.

With some careful consideration in sampling or data and modeling we're able to successfully deploy these optimizations and again realizing over 20% at several sites now, and they're operating as we talk here. That really makes to that when you're spending millions of dollars on chemical for years, so it really good use cases there.

Paul: Yes, and I think too. There's supply chain ramifications like you're saying, making sure that you're not incurring unnecessary resource costs and things like that. You also touched on energy consumption and I think sustainability and kind of that. That energy footprint and I'm sure there's like a carbon footprint ramifications as well, as plant operations are more efficient.

Let me ask you Jen, can you speak to and you elaborate a little bit on potential energy consumption decreases in savings that can be realized, through a smarter approach to how we process and distribute water to people?

Jean: Yes, certainly, as Josh was saying we've tested these data models at wastewater treatment plants, but also in our drinking water facilities we have to pump water. We have to get it out into the system. I really see that when we're processing water and getting clean water out, we can use these same principles, that we've used for their wastewater facilities, that we've used at blowers for aeration, use a similar approach at a drinking water treatment plant at their high service pumps.

Can we maybe trim down a pump here there and start to save some energy, while we're still serving our customers. We're still making sure they get the pressure they need, get the quantity and quality of water that they need. Yes, I do think that that's definitely something that we really can start applying. Like I said we started with

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 can see I would say in the next five years moving more and more towards that OneWater approach, and really we have to use these digital tools to be able to make that happen.

Paul: It sounds like the limitations are really maybe more systemic based on legislative or municipal like, this agency or that agency they use different kinds of, maybe the data is set up or tagged differently, and I'm not data scientist so. You're free to laugh at me if I get these terms kind of goofed up. The limitations are more of how things were set up initially. Now, with this technology we're starting to learn to talk in a common digital language.

The systems are starting to operate together, and then people are starting to see and appreciate the benefits and the efficiencies that can be derived, and so it pushes everyone toward a unified goal. Is that maybe a fair way to cast that?

Jean: Yes, my example is I'm a sewer engineer, I'll start with that. As a collection system engineer, I work with countless utilities that have within their utility, wastewater utility, they have a department that runs the collection system. They might even have a department that runs the gravity system, and another department that runs the pump stations in another door. They have all of these departments with different staff and different managers, and if they're not communicating across the board, things will get missed.

This is really where I can see our new approaches to this in the next five years helping because we can basically say, "You have data everywhere. What if we pull all of this data together and we help you operate your system collectively, your collection system and your treatment plant. Then we can help you solve some of those big issues that you've got out in your system, by maybe we can maximize flow to the treatment plant or maybe we know the limitations of the treatment plant and we can make decisions out in the collection system to better serve the community. It's really what it's going to be about is protecting the public health.

Paul: Absolutely. We have seen too some of those events where water protection has become really important, obviously. Josh, let me bring you in on this crystal ball discussion here like where we're going from here. What excites you the most about Intelligent O&M technology in the coming years?

Joshua: What excites me about the Intelligent O&M technologies in the upcoming years is the curve that we're on technology-wise. I really like Jen's comment about acceptance in the future and I think it's more and more folks start to undergo these changes and incorporate these tools into their workflow. It really is going to catch on and it's going to really grow.

I think with these new workflows and processes, we're able to realize the value of data really quickly and at scale and our ability to iterate quickly through these complex solutions and gain the experience and build our teams and collect more data is really growing. The vast amount of interest from the industry as well, regulators, clients, and consultants, I think is only going to help continue to keep the momentum moving forward. That's one exciting point for me.

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 Intelligent O&M incrementally.

If you take a phase approach that can allow you to be a bit more flexible and it could allow you to realize value early without having to build all the components once. These gradual improvements smooth the transition, and it can allow for targeting specific areas of processes within a treatment facility that can have immediate impact. Breaking that transformation journey into smaller, more achievable goals, I think makes the process a little less overwhelming and more manageable.

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 workers in the infrastructure in water management industry do their job efficiently and keep us all safe and also at the end of the day. Thank you so much for your time.

Jennifer: Yes.

Joshua: Thanks a lot Paul.

Jennifer: Thanks for having us.

[music]

[00:27:11] [END OF AUDIO]