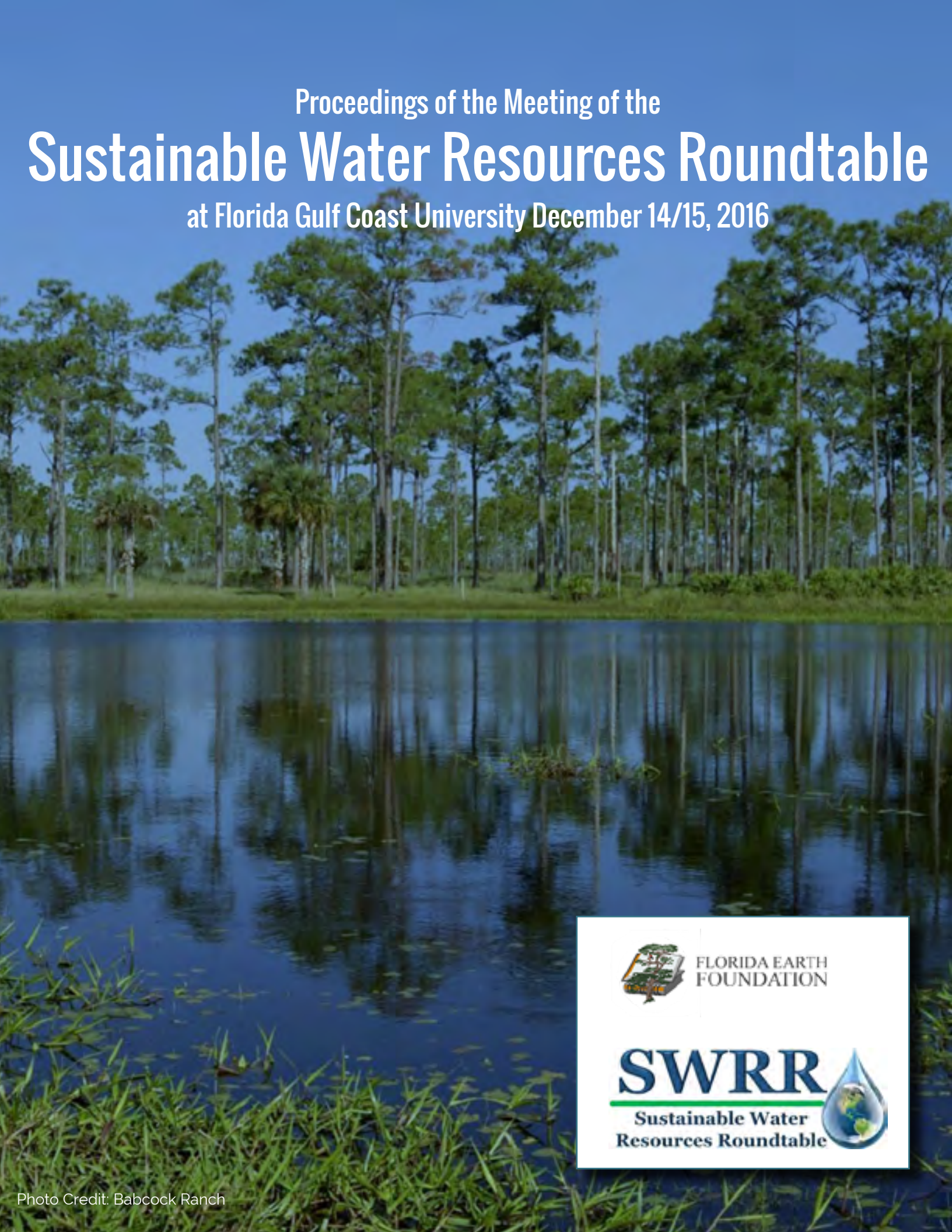
Proceedings of the Meeting of the

Sustainable Water Resources Roundtable

at Florida Gulf Coast University December 14/15, 2016



FLORIDA EARTH FOUNDATION

SWRR Sustainable Water Resources Roundtable

Photo Credit: Babcock Ranch

Table of Contents

Photo Credit: Lake Okeechobee by Simone Dominique

(L to R) John Wells, Co-Chair, SWRR; Rhonda Kranz, Steering Committee, SWRR; David Berry, Manager, SWRR; Robert Wilkinson; Co-Chair, SWRR; and Stan Bronson, Steering Committee, SWRR.
Photo credit Simone Dominique

Mary Babcock at Babcock Ranch
Photo credit Simone Dominique

Babcock Ranch master developer Syd Kitson installing a solar panel at Babcock Ranch
Photo credit Babcock Ranch.

Solar presentation at Babcock Ranch
Photo credit: Simone Dominique

What is SWRR?

The Sustainable Water Resource Roundtable (SWRR) is a quarterly sharing of water information amongst federal, state, private, education, nonprofit, and indigenous nation sectors. The Sustainable Water Resources Roundtable (SWRR) was co-founded in 2002 to support water sustainability efforts of the White House CEQ and Federal Agencies. It is a subgroup of the Advisory Committee on Water Information (ACWI), which advises agencies responsible for managing water resources. The SWRR has hosted multi-stakeholder meetings on indicators, innovative initiatives, and research needs since December 2002, across the U.S.

On December 14th and 15th of 2016, SWRR was held at Babcock Ranch in Fort Myers, Florida, one of the first sustainable towns in the United States, and water professionals from across the nation were in attendance. SWRR Co-Chair John Wells shared with attendees the SWRR vision of ensuring that water helps the environment and has a positive social and economic impact. He said the "main thesis is to achieve sustainability by maintaining impact."

David Berry, SWRR co-founder and Facilitator, told participants they were not *witnessing* a SWRR meeting, but that by being there, they were *part* of SWRR. "The information shared and connections made often create value long after the meeting."

Co-Chair Bob Wilkinson called SWRR a dialogue, which is "meaning flowing through" instead of a discussion which infers, "talks breaking down", and Ernie Cox, President of Family Lands Remembered, LLC. and SWRR speaker, said SWRR "facilitated hard discussions."

Stan Bronson, Executive Director of the Florida Earth Foundation and co-host of the December event noted of all SWRRs, "This one was open to the public." The event fostered a broad range of information sharing and had a theme of collaboration and transparency as a solution to water issues.

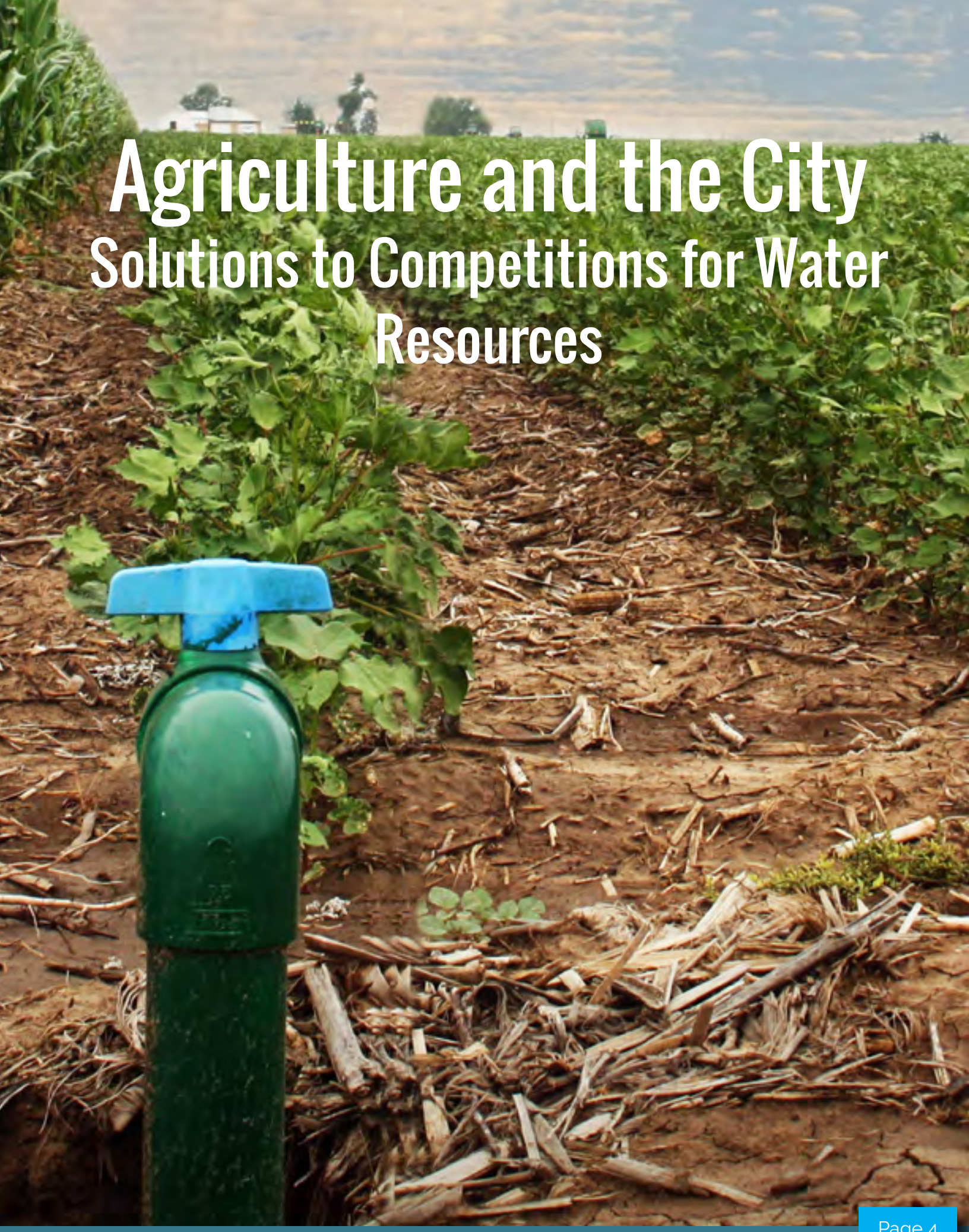
About the Florida Earth Foundation

Florida Earth Foundation is a nonprofit organization that develops knowledge exchange platforms in the water space. Begun as a University of Florida initiative in 2002, Florida Earth was originally designed to help with outreach and education for the Everglades Restoration Plan. In 2004 it was taken out of the university system and turned into a nonprofit. Programs that highlight Florida Earth's global and domestic capacities are:

1. The US-Netherlands Connection's Professional Program – Started in 2007, USNC Pro has taken more than 160 participants from over 20 states to the Netherlands to explore Dutch Expertise in water management, infrastructure and resilience. Operating out of the famous city of Delft, USNC Pro teams travel to locations that illustrate the amazing resolve of the Dutch to overcome the difficulties of a country that is over 40% under sea level. Each USNC Pro experience can be custom made with a variety of outcomes, but always designed to give participants insight into the Dutch way of thinking that created some of the most famous engineering feats on earth. USNC Pro for 2017 will be of particular importance in that it will have subgroups embedded in it that will work on creating a global partnership between the US National Labs and their counterparts in other countries. Dates for this program are June 19-23. Registration and details are available at http://floridaearth.org/usncpro2017. Plans are underway to expand the program into Great Britain in late 2017 and Indonesia in 2018.

2. The Florida Earth Modules – The oldest of the Florida Earth programs, the Modules are two-day educational courses designed to help participants understand and appreciate the complex nature of Florida's environmental systems. The Modules are generally a day in a classroom setting with experts and a day in the field seeing what was discussed the day before. Module themes have been about Natural Systems, Agriculture, Water Quantity and Quality, Ecosystem Restoration and the Water-Energy Nexus. The Natural System Module is scheduled for March 30-31. Go to http://floridaearth.org/nsm2017 for an agenda and registration.

3. Florida Earth and the Sustainable Water Resources Roundtable (SWRR) – Florida Earth is a partner with SWRR and helps with several aspects of the Roundtable. Florida Earth's Executive Director, Stan Bronson, is a member of SWRR's Steering Committee and assists in logistically setting up meetings, communications and proceedings.



Agriculture and the City

Solutions to Competitions for Water Resources

Drip Irrigation. Photo Credit: The U.S. Department of Agriculture

ADAM PUTNAM

Florida Commissioner of Agriculture

Speech, via video. Edited for brevity.

> Of all of the challenges facing our state, I consider water to be our greatest long-term challenge.

Florida's future depends upon an abundant supply of freshwater.

Every corner of our state is now experiencing some form of conflict over water.

"In our panhandle where inadequate water flows have depleted oyster resources, there is hardly anything left to harvest. In Central Florida, [the tourism capital] there will be a one-third of a billion gallon per day shortfall of fresh water by 2030.

Lake Okeechobee on the other hand, discharged hundreds of billions of gallons of water, after a wet season just this past year because the dike, aging, is not strong enough to hold as much water as the lake collects. Since the beginning of 2016, the Army Corps of Engineers discharged hundreds of billions of gallons. Think of what we could have done with that water.

Water is our greatest asset.

It is our common identity in a state, like ours, where our residents are often from someplace else. Water is not just a challenge facing Florida; I think that most people in this room will agree that this is a global challenge, requiring all of our attention.

At the same time that we are experiencing growing conflict over water, we are experiencing growing conflict over food. [...]

Projections indicate that populations around the world will grow by 80 million people per year.

That's the equivalent of adding a new Germany every year. As a growing middle-class changes around the world, as soon as people can afford it, they add fruit and vegetable, and nuts, and proteins to their diets. This will stress agricultural production.

Water is finite but reusable, and the struggle to allocate that water pie and involve new water technologies may well determine conflict, or hopefully, the lack of conflict as we struggle to meet the needs of a

10-billion person population.

As we look to the next green revolution, we must rely less on water and use water more vigilantly.

[..]Because of the new technologies and best practices that our farmers have adopted in Florida alone, agriculture is saving the equivalent of 12 billion gallons a year. ... we are incentivizing growers to use drip irrigation.

Florida has made the conservation of working, agricultural lands and their environmental benefits a top priority. Since 2011, we have used conservation easements to permanently preserve more than 24,000 acres of environmentally sensitive farms and ranches from development.

These easements also allow the land and agricultural operations to continue to operate and contribute to Florida's economy.

But solving this challenge can not just fall on the backs of farmers and ranchers. All sectors of water users have to continue to make strides to improve efficiency. Per capita use of water is lower in Florida today than it has ever been, and it continues to fall statewide, despite the continuous population increases.

Even though a 1000 new people a day are moving to our state, we are using less water per capita. [...]

I am excited that you will get to see [...] innovative solutions, firsthand, this week.

I can't think of a better example of a forward thinking community than Babcock Ranch. [...]

Babcock Ranch is leading Florida into the future for sustainable development and infrastructure.

From solar energy production, gray water irrigation systems, and storm water recovery, it sets the new standard for a sustainable community.
It also sets an incredible precedent for future development by working with the state to preserve more than 80% of the original ranch.

Babcock Ranch and Babcock Ranch Preserve are a model for others to follow.[...]

We must get out of the habit of using water only once.

Florida is recycling more than 40% of the total wastewater flows. We have constructed hundreds of domestic wastewater treatment facilities to provide nearly a billion gallons of water per day of reclaimed water that can be put back into the system.

But conservation and renewal reuse alone will not be enough. The next step must be to explore more sources of water that won't be depleted.

We must find ways to grow our water supply from sources that are resistant to drought and shortage. Simply put, our water supply options must become more diverse. [...]

No one has a monopoly on solutions to this global crisis.

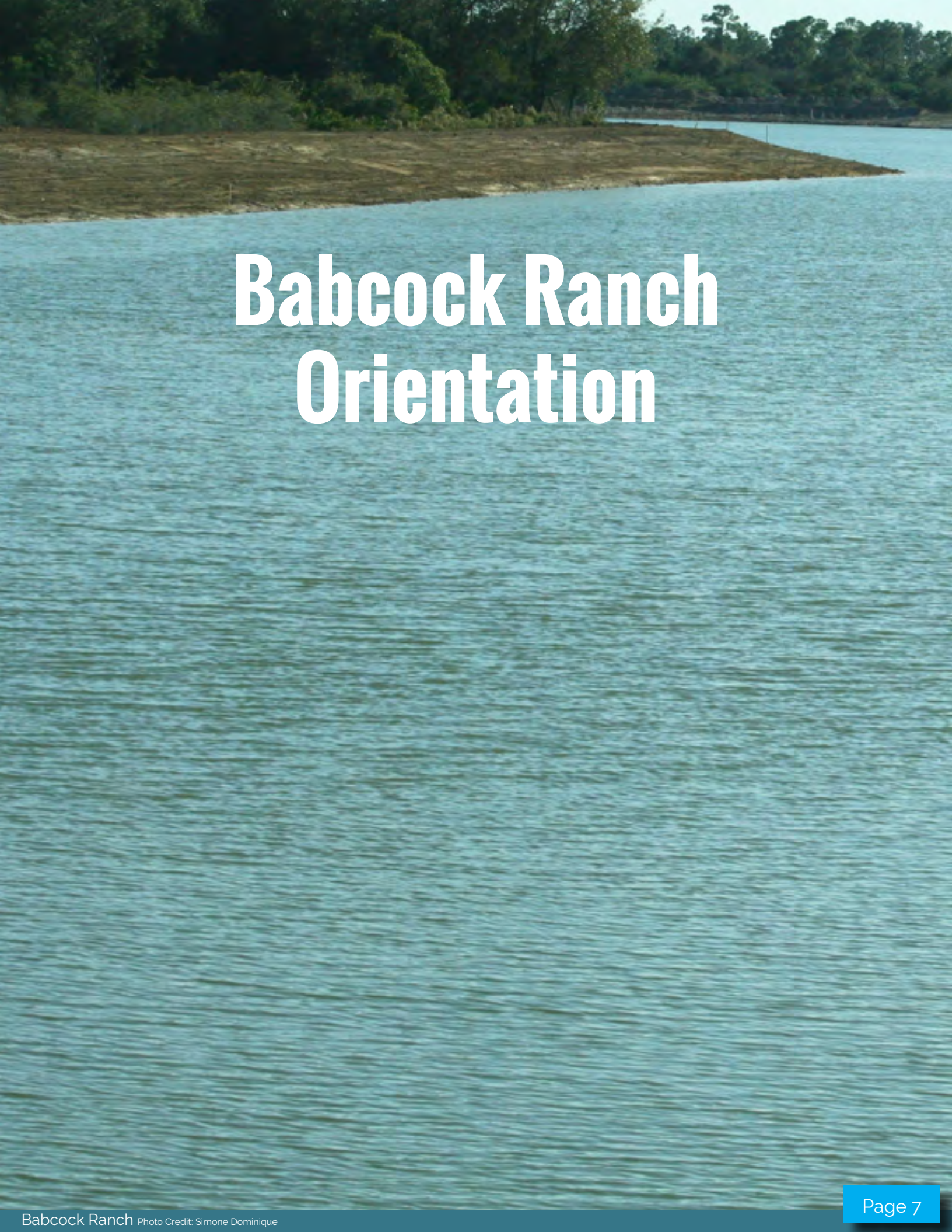
And to the extent that there are ways for us to continue to collaborate and partner with one another to meet the diverse water needs from Florida to California, and around the globe, this gathering is an important opportunity to do just that.

[...]

If we want to continue to attract businesses, draw tourists, while protecting our natural resources, and feeding the nation, we must ensure that we have the water supply to meet our needs, not just for today, but for generations to come.

[..]

Thank you for your dedication to our precious natural resources.



Babcock Ranch Orientation

Syd Kitson

Chairman and CEO, Kitson & Partners LLP, Master Developer of Babcock Ranch and Babcock Ranch Preserve (The largest preservation purchase in Florida's history and the United States' first solar-powered town.) SWRR presentation edited for brevity.

> "There were people who were not in favor of it, and they wanted the entire ranch in preservation forever, and I totally understand that–they had every right to do that, and I would like to think that they made us even better.

We wanted to think about how we can create this land so that it could be additive to the generations of the future and not take away from them.

So our stated goal is to create the most sustainable town in the United States and we want to prove that preservation and development can work hand in hand.[...] And we are now in the process of building the largest new town coming out of the ground in the United States.

On July 31, 2006, we purchased this 91k acre ranch, and then we turned around and sold 73k acres to the state of Florida in the largest land purchase in the history of the state. We ended up with 18k acres, and out of the 18k acres, we are preserving 50% of that. So at the end of the day, 90% of the original ranch is in preservation forever and that is something that we are very, very proud of.

There were people who were not in favor of it, and they wanted the entire ranch in preservation forever, and I totally understand that–they had every right to do that, and I would like to think that they made us even better. It's a matter of listening when people have problems, or oppose you, rather than just rejecting it, and we tried to do that [to listen].

Our environmental groups [...] stepped up and said, "We realized that in order to preserve this land, we need to create this new town, but let's create this new town in the right way, and in the end it worked.

In order for us to be successful, we absolutely needed the help of all the environmental groups and they all stepped up, and it was fantastic. And local leaders and the government, without that, it just simply wouldn't have happened. And then we had a series of charrettes, where we brought all of the public in.

We also did something pretty unique,

and it made it very complicated. We created this private-public partnership to manage the ranch, and I think we spent more time working through that management agreement than we did on the actual purchase of the land itself.

But the Babcock family was incredible in the stewardship of this land. And what people don't realize is, to keep the land pristine, you just don't leave it and let it go.

It takes a lot of work and a lot of money to keep the [invasive plants] out and to make sure that you get through all the burning and all of the things that go into making it pristine. And so we said to the state,

'Why don't we form a 501(c)(3), and let us manage it for 10 years, and we'll leave all the funds from the ranch operations to fund it, and we won't have to guess where to ask for any money from the state, and it will be totally funded.' And for 10 years, that's exactly what we did, and it worked. We kept the operations going, [...] and now it has been turned over to the state.

Building a sustainable community, it all begins with the land.

For us, we went back and looked at a map from 1940 and 90% of the town will be built on previously impacted pasture land, farm land,[and] mining land. [This] 90% is on already-disturbed land.

And you'll see from the flow ways, we aren't going to fight nature here.

We are going to work with it. [...]

We have resources on the property that we are going to be able to use. We have a mining operation so all of our aggregate, all of our fill materials are coming right from the property itself.

We have on-site farming, we have a restaurant so all of our food is right from the ranch itself. We have a sod farm. We are going to limit the amount of turf coverage to 30% of residential lots to conserve water.

So what you are going to notice [is] there is no grass along the boulevard. It's going to be ground cover and natural planting, and trees, and bushes and the reason that we are doing that is the last thing that I want to have is to have the lawn mowers cycling 24 hours a day that you have in many towns. [...]

The use of native and naturalized landscape materials, is important to us. By way of coincidence, after a hurricane or natural event, that is what is still standing–the natural landscape. It use[s] less water. 75% of all trees and shrubs will be native plants.

And 100% of all irrigation will use reclaimed or gray water that is provided by an onsite water utility.

We own the utility. We are building it now.

I would tell you that smart growth, in my mind, is important today or more important than it was in 2005. Not only is it the right thing for the environment, but it is smart business. And we are learning that very, very quickly.

If we prove that this makes sense financially, a lot of other people are going to do it.

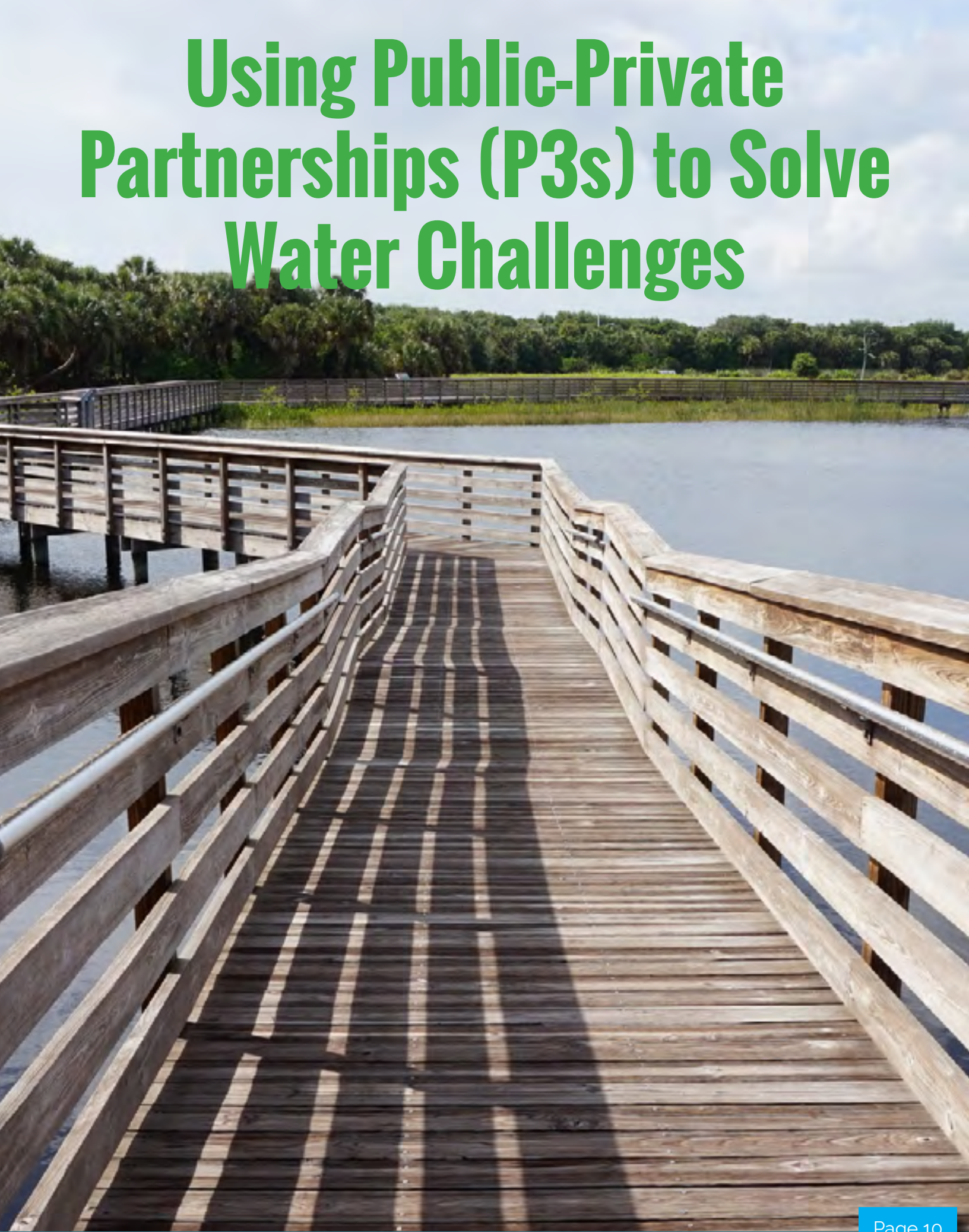
So we are absolutely working on that, and we want to make that happen.


Babcock Ranch
Photo Credit: Babcock Ranch

KITSON & PARTNERS

BABCOCK RANCH

Using Public-Private Partnerships (P3s) to Solve Water Challenges



Green Cay Wetlands, Florida. Photo credit: Florida Water Daily

Ernie Cox

President, Family Lands Remembered, LLC. and Project Manager for Palm Beach Aggregates. Cox created the Babcock Ranch private-public partnership (P3). SWRR presentation edited for brevity.

> “Get it all out on the table and then decide, where do our interests intersect?”

I like to tell people, in Florida, we have 2 seasons of water, too much and not enough. [...]So the idea is basically how to keep water that is going to tide [for when] we need it. [...]

The c-51 [private-public partnership] was originally designed as a water supply project. [...]This complex is located at the intersection of almost all of major canals in Southeast Florida.

The concept is too much water [is] being dumped into the Lake Worth Lagoon in South Florida, [so] capture it, store it, and release it to recharge the aquifer. [...]

If you don't release water to tide, it does a really good job of recharging the aquifer. [...]If you look at cost comparisons, reverse osmosis works but is expensive from a capital and operational perspective over time. [...]

Reuse to recharge is an even more expensive technology. I believe that we need to be doing all of this and have a balanced portfolio but [..] you have to do cost analysis of the best solution for that scenario.

For every milestone, there [was] a public meeting. [...]This is a very transparent process.

The private partnership part of this involves public utilities, it involves lower East Coast governments, the SFWMD, the Florida EPA, drainage districts, and I am the manager for the private sector partner which is Palm Beach Aggregates, which is a mining company and also a construction company. We worked through this project in a collaborative way.

These are the basic documents by which we were able to put this deal together:

- C-51 Reservoir – P3 Structure
- Interlocal Agreements: Feasibility Studies, Cost Estimates, Etc.
- Formulating Task Forces and Working Groups
- Project Protocol Memorandum of Understanding
- Resolutions
- Letters of Intent
- Conveyance System Agreements
- Capacity Allocation Agreements
- Operation and Maintenance Agreement
- 501c3 Entity
- Transfer Agreements Upon Completion

I am a firm believer that if you are going to get something done, whether it is between multiple agencies, or 2 state agencies etc., or state and a federal, you have to [figure out] the common interests, and you have to be honest with each other. [...]

Get it all out on the table and then decide, where do

our interests intersect?

We tend as human beings to spend most of time on the outside of this chart, fighting about where our interests don't intersect, and it leads to a lot of frustration and sometimes bad feelings.

If we spend more time on the areas where our interests intersect, we would get a lot more done.

[...]

P3s are hard. The reason that they are hard is because they are different[...]because you are basically saying that we are going to work together to get this [..] done faster. [...][We cut the process time down significantly.

If you are doing a P3 project there is a lot of personal interaction and the whole team has to be committed to that upfront, otherwise it is doesn't work. We also brought in the regulatory agencies who would be issuing the permits–early and often.

The biggest thing that I learned in this project is that everybody that is going to touch it at some point in its life, get them together early.

The natural structure of a p3 can be very flexible [...] and very creative.

[...]Regarding spending public money on private partnerships, you have to look at the objective. If the goal is to recharge an aquifer, then you look at the natural lifetime of pipes and equipment and pumps, the ownership isn't as important. We have to evaluate what our needs are and our timing. If a government agency [needs to do a $200 million project and doesn't] have $200 million in the bank, and if you are able to spread that out over time, it makes sense.

My belief is that you have to a real clear, transparent comparison of alternatives, as compared to your budget. [...]

There is a value that is not captured currently in our planning process for environmental restoration,

and it's the opposite of the [financial term] net present value of money (NPV). On the public side, the longer I wait to restore a resource, the more damage happens. So if there is a project that is scheduled for 20 years down the road and there is a way to move it up to 5 years, there is a value there that somehow we have to capture, because if I am an estuary [on the verge of collapse], I don't need help 20 yrs from now. I need help now. [...]

A question that I am asked a lot about P3s is, 'Why should we pay the private sector to do this project?'

My answer to that is let's look at a traditional public project, [...] 90% of the money that you spend is going to the private sector anyhow, [i.e the companies that are hired], and you also have the expense of the public sector overseeing the private sector. If you do this in a very open process, you shorten the whole thing and remove transaction costs. Part of the strategy of the project has to be to build in public review and public input, and you do it as early as you can, and you do it at critical junctures.

FAMILY LANDS REMEMBERED

Solar Energy and Babcock Ranch

Babcock Ranch Solar Panels. Photo Credit: Simone Dominique

Buck Martinez

Sr. Director Project Development, Florida Power & Light Company

FPL installed 343,000 solar panels at Babcock Ranch.

Presentation edited [...] for brevity.

> From a legacy perspective, you always say, "What did I leave behind?" For us [FPL], we used 40 million barrels of oil in 2001, today we are [using] zero. That's huge.

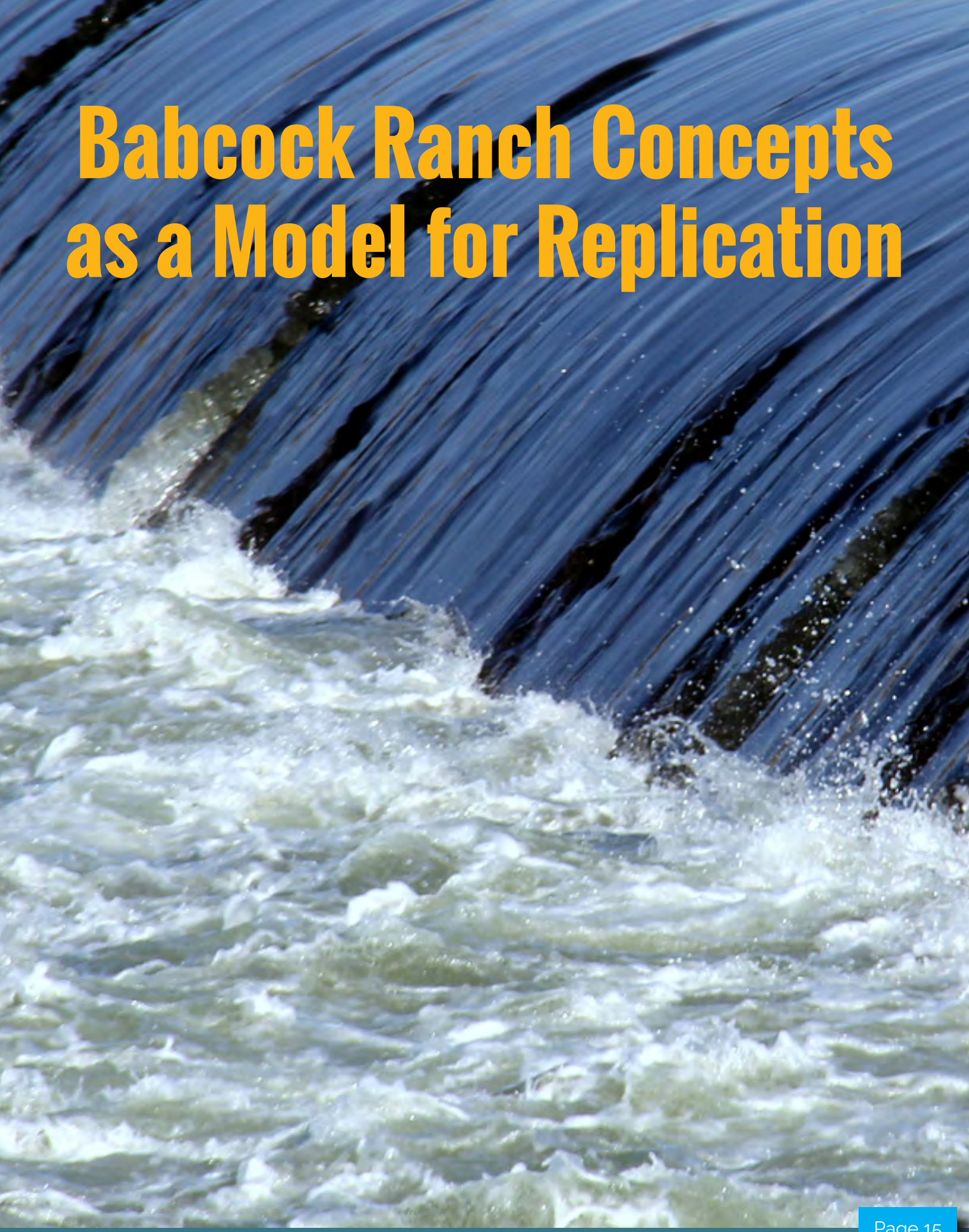
[Regarding solar power,] in California they started with subsidies and mandates.[...]So if you live in California, especially in the LA area, you are paying 20.5 cents a kw/hour for your energy. If you live in Babcock Ranch, you will be paying 9.2 cents a kw/hour. So Babcock ranch is being built without any state subsidies, any state mandates, any impact on our customers' taxes.[...]

It is generating zero emissions, and it has no water impact. We have a fairly robust natural gas economy, we are about 68% natural gas. For every 1k megawatts of natural gas, you are using 7.5 million gallons of water a day. Now you understand why solar is becoming so important.

FPL today already complies with the 2030 Clean Power Act. Most people don't realize that there are 55 utilities in the state of Florida, many of those are co-ops which use coal as their source of fuel, [which could make it challenging for them to comply].

Kudos to Syd [Kitson] for his thinking and his vision. I would argue that most cities will look [to] Babcock Ranch going forward.

Babcock Ranch Concepts as a Model for Replication



Weir, Photo credit: Cory Denton

Amy Wicks

Project Manager at Kimley-Horn and Associates, Inc.

Presentation edited [...] for brevity.

So, we are very passionate about what we do.

We started the restoration on Babcock before we started the community...before a shovel went in the ground, and that was to capture that passion.

In the '40s they used to show this Disney commercial [The Winged Scourge] before movies. It shows how far we have come as a society. It talked about how to drain wetlands to kill off plants.

And so it wasn't that anybody was a bad steward of land, we just didn't understand back then. Now we know how to do it right, and we need to start doing it right.

So here is an aerial and present day Google earth. Between 1953 and 1999, there were some significant changes to wetlands at Babcock. Agricultural operations did come online, and it really did kind of impact all the wetlands out there, so they started to disappear.

So what we are doing within the community is,

we kind of start to mimic what was there before with wetlands.

We are also using rain gardens, bioswales and trails to pull people out there to educate them on how these work. We don't want people to go into their backyards and kill all the wetland plants.
And we actually have some proposed backyard wildlife habitats which are very similar to rain gardens. We are going back and restoring all of these small little pockets of weltands that were all over.

[...]We are really putting a lot of time into studying and making sure we were still going to keep those wetlands hydrated.

We have tons of lakes, most of them are over five acres, so we have really good water quality treatment.

At the end of that whole treatment system we are doing this series of filter marshes, about 358 acres that are then going to filter the storm water runoff prior to discharging off-site.

Then, we did some nutrient loading calculations. Now there is a 54% improvement in nitrogen and 87% improvement in phosphorus discharging off the site.

So when the community is completely developed and built out you'll see that net improvement.

The wastewater treatment plant is going through an additional chamber and then 100% of it is going into the mining lakes, which were on the property already, and are going to store the reuse water. That will all be used for the irrigation of the community.

Kimley»Horn

Laura Herrero

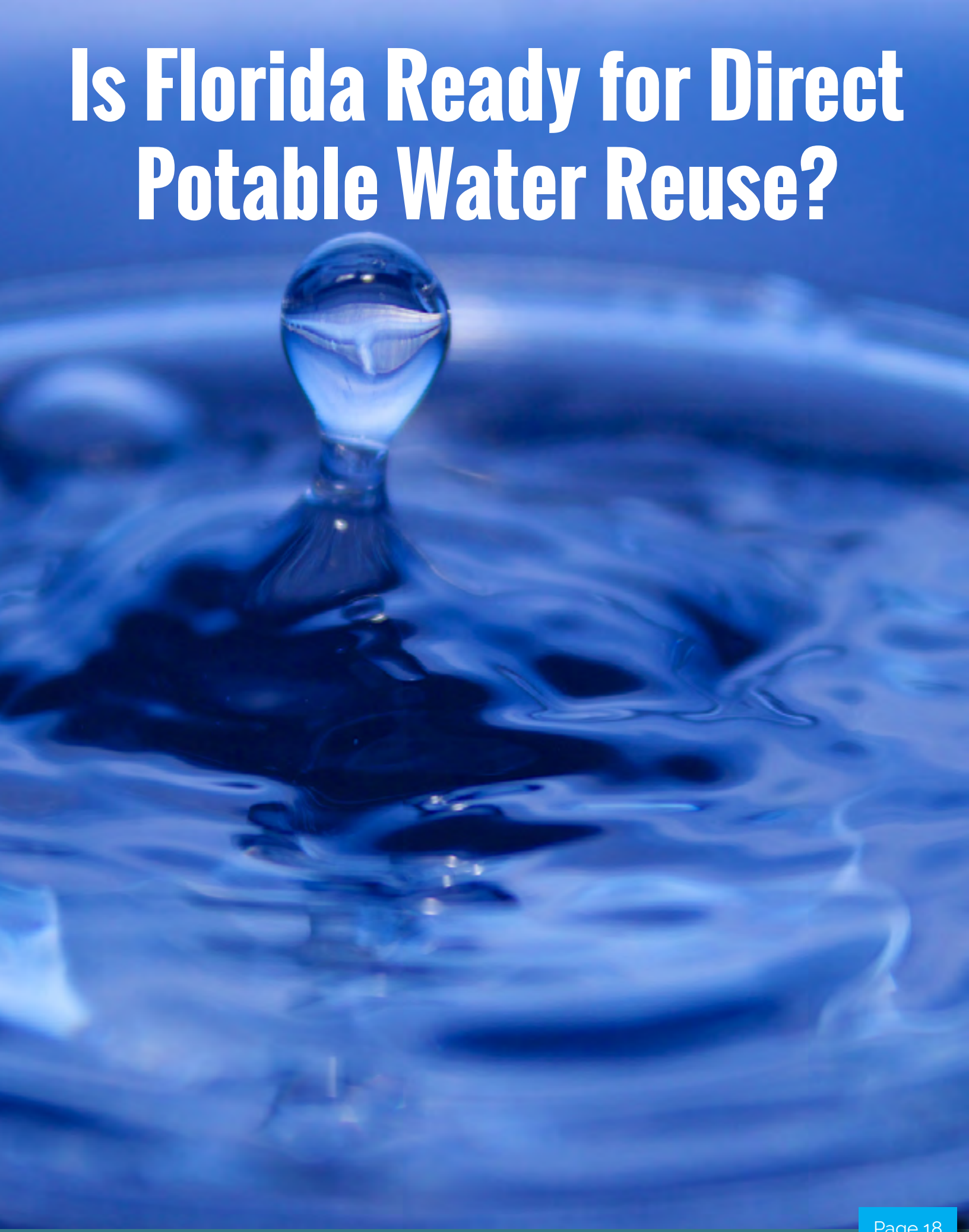
Johnson Engineering

Bulletpoints of presentation at SWRR

Babcock is one of the largest contiguous parcels in Florida. Telegraph Cypress Swamp wetland is about 24,000 acres of the preserve.
Babcock Ranch used 'good stewardship' practices and left the non-agricultural areas alone.
Curry and Big Island canals were built to drain the land and were present in 1944.
In the 1970s, Big Island realized over-draining.
Master developer Kitson & Partners was not the highest bid but the Babcock family wanted people who had the same mindset they had: conservation.
The properties are being built on former agriculture and mining land. Added some parcels and removed others. State road 31 future wildlife crossing. Area 6 = final boundary for BR community.
Detailed aquatic faunal analysis. 30 sample sites for 3 yrs. What to monitor integrity and have reference conditions.
Wetland hydroperiod analysis. Well map data shorter days of inundation that was thought. Created hydrographic where water was verus need of water for different habitats.

Babcock Ranch rendering. Photo Credit: Babcock Ranch

Is Florida Ready for Direct Potable Water Reuse?



Chuck Drake

Board Member, Water Environment Research Foundation, and PG, Tetra, Inc.

Presentation edited [...] for brevity.

Approximately half the water we use in Florida is for drinking water supply and half of that goes to irrigate our lawns; the other half is what we use inside our house. Water used inside our homes goes to a wastewater treatment plant, reclaimed water treatment plant, or an advanced waste treatment plant.

We can build a water purification plant to treat water from these sources that meets or exceeds potable drinking water standards. That water is potable reuse water and can be used for aquifer recharge, or send it to drinking water treatment plant for reuse and constant recycle.

Although we can't reuse 100% of the water from our homes, but we can use pretty close to it. The recycled water represents an established water supply that's already in place, which allows us to reduce the amount of fresh groundwater or surface water that is used.

The Water Environment and Reuse Foundation is the prime advocate for water reuse in the nation.

Florida has worked for over 30 years to reduce our per capita consumption of fresh groundwater, and as result, Florida reuses about 730 million gallons a day, leading the nation in water reuse. That is one of the reasons why our withdrawals of fresh groundwater have essentially been the same for the last 10 years while our population has increased significantly during that time.

The Central Florida Water Initiative was formed to determine the safe groundwater withdrawal limits and to estimate future water demands. Extensive groundwater flow modeling was conducted to determine potential impacts from that work as well as evaluating on surface water bodies and wetlands.

> In Central Florida, we withdraw about 800 MGD, and by 2035 we will need 1.1 billion gallons per day to meet projected demands,

assuming that per capita rates remain constant.

The CFWI team found that we can withdraw an additional 50 MGD without adverse environmental impacts.

This means that there is the potential for a 250 MGD deficit in water supply and that alternative water supplies are needed to meet future demand.

The CFWI RWSP identified 144 alternative water supply projects that could provide up to around 400 MGD of water to offset the 250 MGD that can't be met with traditional supplies.

So what is the potable reuse process?

> After you treat from a reclaimed water treatment plant, ultrafiltration (UF), reverse osmosis (RO), and then Advanced Oxidation Processes (AOPs) are used to produce water that meets or exceeds drinking water standards. In the end, almost everything is removed, including unregulated compounds.

The chemical NMDA is used as a surrogate for many other chemicals, such that if

NDMA isn't detected, there is reasonable assurance that all others are removed.

The City of Clearwater is a leader in indirect potable reuse and wanted to educate the public about their project and conducted numerous pilot plant project tours, implemented public outreach and developed a website about the project. This education and outreach greatly enhanced the project, which is now under construction.

With respect to public education, the WateReuse Research Foundation conducted a survey asking who the public trusted the most with respect to the quality of their water. The results were the Department of Health and medical researchers. One of the most important aspects of a potable reuse project is the public education and outreach, and it was demonstrated in Clearwater that public acceptance was greatly improved by the education that was conducted.

A recent project was conducted by the WateReuse Association in Hillsborough County. The project team consisted of Hillsborough County, Tetra Tech, Xylem and GE. The team constructed a potable reuse pilot project that treated water from the County's Falkenburg Advanced Wastewater Treatment Plant. The process utilized ultrafiltration, reverse osmosis and advanced oxidation to produce water that exceeded drinking water standards. That water was collected by local home beer brewers who produced 27 styles of beer. The beer was divided into 4 judging categories and the winners were announced at the New Water Brew contest held during the 2016 WateReuse Symposium.

We tested unregulated microconstituents like caffeine, 17-b-estradiol and found nothing. The concentration of many of the constituents was below detection limits, or if detected, was at the 10-9 concentration. For example, the concentration of caffeine was 941,000,000 times LESS than in a cup of coffee. The anti-inflammatory Naproxen was found to be 626,000,000 times LESS than the reference health level.

Florida Senator Simpson wants to remove regulatory hurdles to potable reuse, as long as the public health and safety are protected. Over the summer of 2016, multiple stakeholders including the water management districts, WateReuse Association, the Florida Utility Council, Florida Department of Agriculture and Consumer Services, Florida Audubon, and others, met to provide input to the FDEP who would draft legislation to give to Senator Simpson. The biggest issue is to identify reclaimed water as a source of drinking water.

How does the cost of potable reuse compare to other sources? It's not an exorbitant cost. It's not something that is going to break the bank. It's right in the range of brackish groundwater reverse osmosis, is less than surface water or ocean water desalination. In many parts of Florida, the only available supply will be from alternative water sources, so the cost of potable reuse should be compared to other AWA projects, not traditional groundwater.

Is Florida ready for reuse? The answer is yes. We are doing it. We have demonstration projects going on right in the state for potable reuse that shows it's affordable and the water exceeds drinking water standards.

TETRA TECH


Innovations
in H2O Technologies

Marianna Grossman

Founder and Managing Partner, Minerva Silicon Valley

> We know changes are coming.
> What are we doing to plan for them?

What will be the salinity infiltration into our water supply? What will be the sea level rise consequence that we have to deal with? What will be the drought, or the flooding, or extreme storms, and high winds?

It's important to be able to talk openly about concerns because they happen, whether or not we discuss them.

Here an example of a technology, developed by an Israeli company, that listen to leaks in water systems–on the public side of the meter and helps to detect them. Every water system loses a lot of water in its place.

This is one of the other things we like to think about: all of the different sources of water in a more integrated way.

Advanced water purification treatment, as Chuck talked about. There is plant in Orange County that is already operating as a new plant. There is one is San Francisco that is at 8 million gallons a day planning to go to a lot more using the process that Chuck described and treating wastewater for potable/ non-potable uses.

And then there are also people working on decentralized water treatment and reuse. So water capture, treatment, and use in buildings and then there are different kinds of reuse technologies: biological , chemical, and mechanical. And sometimes those are combined.

San Francisco Public Utilities commission is doing is a lot of innovation. They manage water not just for San Fran, but they also sell water to 28 water agencies in the Bay Area. They are serving millions of customers, and they are really concerned about the limits on the freshwater that is coming in. They are trying to limit the amount of water reuse for various purposes, so an alternative water source could be any of those things on that list rainwater etcetera. With appropriate treatment, you can use it for non-potable end use.

In commercial buildings, about 75% or more of water, maybe up to 90 or 95% of water only needs to be non-potable standard for things like toilets, cooling, laundry, commercial processes. You don't need to have potable water for those purposes.

The SFPUC building reuses water. They get rainwater that's pretty clean, stormwater that's pretty dirty, and nuisance ground water from, maybe, pumping out. There may be waste water from grey sources and black sources which include kitchen sinks and toilets.

Here is an example of grey water being reused in a new high rise in San Fran that has commercial and residential and all of their toilets are being flushed with grey water that they are producing in that bldg.

This is a San Francisco public utility building. You can see this area along the edge of the bldg and the other side of the bldg are constructed wetlands that have bacteria and other micro organisms that are digesting the black water that is being pumped through.

The roots of the plant also are assisting that process, so it makes a pretty architectural feature and inside the building there is a lobby that has more plants. They treat the water with UV and then reuse it in the bldg for greywater purposes, flushing toilets, cooling and also some irrigation.

Another company is called Intrysic, and they are using some interesting biological

remediation systems to clean water. They can take a lot of nasty stuff out of water through floating islands or through planting of trees.

They put microbes in the roots of the plants to take out different things, like heavy metals, TCE, and hazards materials. They really clean up the water, and then they can pump it through a plant to the area and really get a lot of bad stuff out of the water.

Biomass can be harvested, so where they are taking heavy metals out you can actually smelt the plants and recover some of that metal.

They have plants targeted to the particular issues of the water. This seems to me to be a very useful for wetlands restoration where you put in plants that are specifically suited to clean up the water then you don't need to use chemicals or an energy intense use. Basically, sunlight is the energy that drives these plants.

With respect to traditional water treatment, reverse osmosis is a pretty old technology. There is a company called Desalitch that is doing basically multiple-pass systems. They are much more efficient in how they use water, and they use a lot less energy than traditional reverse osmosis.

When you are doing a kind of system like the one that Chuck described, this is the kind of innovation in technology that people are already using in beverages, forestry, and lots of applications for cleaning groundwater, etcetera.

Stanford is doing some really interesting work. They are saying there is a value in water. They are studying an anaerobic system which is operating in South Korea. What they are doing is capturing the energy from the methane and the biosolids to be able to have, essentially, a net-zero energy, zero greenhouse, gas emission process that produces not only clean water but recovers other resources from the water as well.

And that is where sometimes innovation can really switch the process you are doing. I mentioned about smart grid for energy, for water. Here is an example in Portland, an eco-district where they are putting water management and energy in a circular kind of method.

This is a DC school that is doing a lot of good work capturing and using storm water.

The last thing that I wanted to address was policy. There are different ways of creating markets for water rights.

If you give people an allocation, let's say each business or home gets 100 units of water, and they only use 80, they can sell their 20 units back on the market. And people who need extra water can buy it at a higher price.

That way you can have differential pricing for people who use more water and that helps incent them to do water innovation.

Then the last point that I wanted to make is about pricing water at the accurate cost for replacement. A lot of times, people are charging for the current cost of water, not for the future cost.

I think that water is more like blood than sand. It's precious, and we should price it accordingly.

Those Amazing Satellites

Space. Photo credit Sweetie

Cathy Johnson

Catapult Satellite Applications

Presentation edited for brevity.

The organization I come from is based near Oxford, UK, at a site of major scientific instruments.

We are involved with how you use the data that comes back from space.

In the US, we have the Eyes and Seas project which is about trying to end overfishing. We also work with the U.S. Coast Guard and the insurance sectors.

The satellites that I am talking about today are located in the low earth orbit, which is about 180 to 2000 km above the surface of the earth.

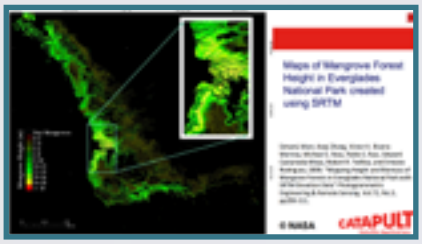
The human eye can only see in 3 colors, bright green, yellow and blue. Satellite technology can see a much wider band, and infrared can look at plant species, molecules, water content, we can also look at water pollutants, and damage to plants.

Looking at algal blooms, this is Lake Erie and one of the things that satellites are really good at is, you can detect chlorophyll from space.

You can't detect potassium or nitrogen, but you can detect chlorophyll which is usually a very good proxy variable for potassium and nitrogen.

Satellites are really useful for detecting change. So here we have Lake Mead and what can see now are changes from 2000 to 2015. You can go back in time and can basically create a total picture of change.

This is imagery of the biomass of mangroves and height.



If you combine that with infrared,

you can start to look at the health of these plants so you get an overall picture.

This is jellyfish imaging in the UK, and they are around nuclear power plants.

What you see highlighted in yellow is a huge area of jellyfish, and they are heading into the water intake of this power plant. This is a huge problem for power stations because the jellyfish get into the cooling system and then the system has to be shut down before there is a lot of damage done.

What can do is use satellites to identify jellyfish and then shut down the system before jellyfish get in there.

CATAPULT Satellite Applications

Achieving Sustainable Water Resources

Through Technology and Innovation

Photo Credit: Babcock Ranch

Jeffrey Lape

Deputy Director, Office of Science and Technology, U.S. EPA

> We identified 10 market opportunities where we think innovation and technology can solve problem

Thank you, Stan and Dave for bringing together this group. I sit in the policy/regulatory/technology nexus. What I would like to try to do is help make the business case for innovation and technology. I will make it from an external perspective, there are a lot of great experts out there as well as what the EPA is attempting to do. I will show you some early adopters and the great work that they are doing, and I will end with a blog with where we need to go to next.

For those who have been in the water world forever, we remember the Cuyahoga River is the iconic example of a larger problem of the past. Today's problems are far more challenging and difficult. I simply like to characterize our water crisis as: too much, too little, poor quality, and wrong place. And how quickly can that change, in a heartbeat, right?

So people like Buzz Thompson and Newsha Ajami with Stanford University have made the case for why we need to innovate in the water sphere in their work: *The Path to Water Innovation*. David Sedlak from UC Berkeley has written a book *Water 4.0: The Past, Present and Future of the World's Most Vital Resource.* It helps us chronicle where we have been and tries to take a look at the future, beginning to introduce that notion of not just centralized systems but de-centralized systems.

The Johnson Foundation convened experts over the course of several years including with this report, I love the title, *Navigating to New Shores - Seizing the Future for Sustainable and Resilient Water Future*. They did this because they knew we have a water crisis. The Aspen Institute and Nicholas School at Duke University similarly saw a need for innovating the future, again, look at the title, *Innovating for Sustainable and Resilient Water Future*. They brought together experts from all over the country representing every possible nonpartisan way to say how are we going to innovate our way out of this water problem we have.

Even the utility sector recognized that they need to shift from being viewed as a wastewater utility into a resource recovery entity. Last March, the White House convened the White House Water Summit, again, as an example of, we've got a water problem, we have got to figure out how to fix this.

The EPA has also been trying to express our view of the urgency of solutions to problems. In 2013 and 2014, we issued blueprints and our progress report in 2015, considered an attempt to say, "We've got a problem, what are some examples of fixing it?"

We identified 10 market opportunities where we think innovation and technology can solve problems:

1. Conserving and Recovering Energy
2. Recovering Nutrients
3. Improving and Greening of the Water Infrastructure
4. Conserving and Eventually Reusing Water
5. Reducing Costs and Improving Techniques for Water Monitoring
6. Improving Performance of Small Drinking Water Systems
7. Reducing Impacts from Energy Production
8. Improving Resiliency of Water Infrastructure to the Impacts of Climate Change
9. Improving Access to Safe Drinking Water and Sanitation
10. Improving Water Quality of Our Oceans, Estuaries and Watersheds

I am going to give you examples of 5, and examples of the early adopters who are really going to make this happen.

First, let's talk about water energy and wastewater nexus. There is lots of embedded energy in waste water. There's chemical energy, physical energy, and thermal energy. How do we take advantage of that? There are 15,000 wastewater treatment plants in the country, that consume one to two percent of the nation's electricity, moving and treating that water.

And every one of those can become energy producers. So Eastbay Municipal Utility District in California and Gresham, Oregon are producing more energy than they consume. They are energy positive. They were first. So how do we get to 15,000, how do we scale up their opportunities?

Second, nutrients. We all know the nitrogen and phosphorous are essential nutrients, however, existing levels in surface water are causing serious public health (e.g. harmful algal blooms) and ecosystem problems in the form of nutrient pollution. What if we can actually extract the nitrogen and phosphorus out of the water? So there are about a dozen wastewater treatment plants in this country who are doing just that ...extracting the crystalline form of magnesium ammonium phosphate (MgNH4PO4),

So the Metropolitan Water Reclamation District of Greater Chicago, with the largest wastewater treatment plant in the world, is now deploying full-scale nutrient recovery.

Third, market opportunities for infrastructure. I am going to suggest to you, whatever you think of green infrastructure is, I want you to think about green infrastructure on steroids. It's not just about maximizing the value of stormwater. It's full reuse on multiple scales.

There is a fellow David Wagner, an architect working in New Orleans and the Netherlands, who is advocating the concept of "living with water". It's fundamental rethinking and redesign of our urban environments where we embrace and live with water. And you begin to design our communities around that notion of allowing water into purposely designed areas, rather than building walls to keep water out.

A fourth, market opportunity is around water reuse. Droughts in the west are compelling cities to preserve and conserve precious freshwater (surface and ground water). There are many growing examples across the landscape. Orange County, CA putting a hundred million gallons a day of cleaned wastewater back into the aquifer.

In Wichita Falls, Texas, a community of 105,000 people, their reservoir simply went nearly dry in 2013. So what was their solution? A 13-mile pipeline from the wastewater treatment back to the drinking water plant, [it] became one of the first "direct potable reuse" facilities, reclaiming five million gallons of water a day. Yes, they did a lot. They put in the best technology that could be found. The best sensors. The best automation. The best data systems. It takes a drought sometimes to change people's behaviors.

The fifth market opportunity is about enhancing our information about water through technologies like sensors.

I would like to close by referencing a statement issued by Administrator Gina McCarthy last week. She framed it as "water challenges are actually opportunities". I will actually take a moment to read this with you because it says where we need to pivot as a nation.

"Our nation needs to talk more about the future of water, which I believe is one of the top public health and economic challenges now facing our country.

We need to accelerate the move to a 21st century view – where we see water as a finite and valuable asset, as a major economic driver, as essential to urban revitalization, as a centerpiece for innovative technology, and as a key focus of our efforts to build resilience.

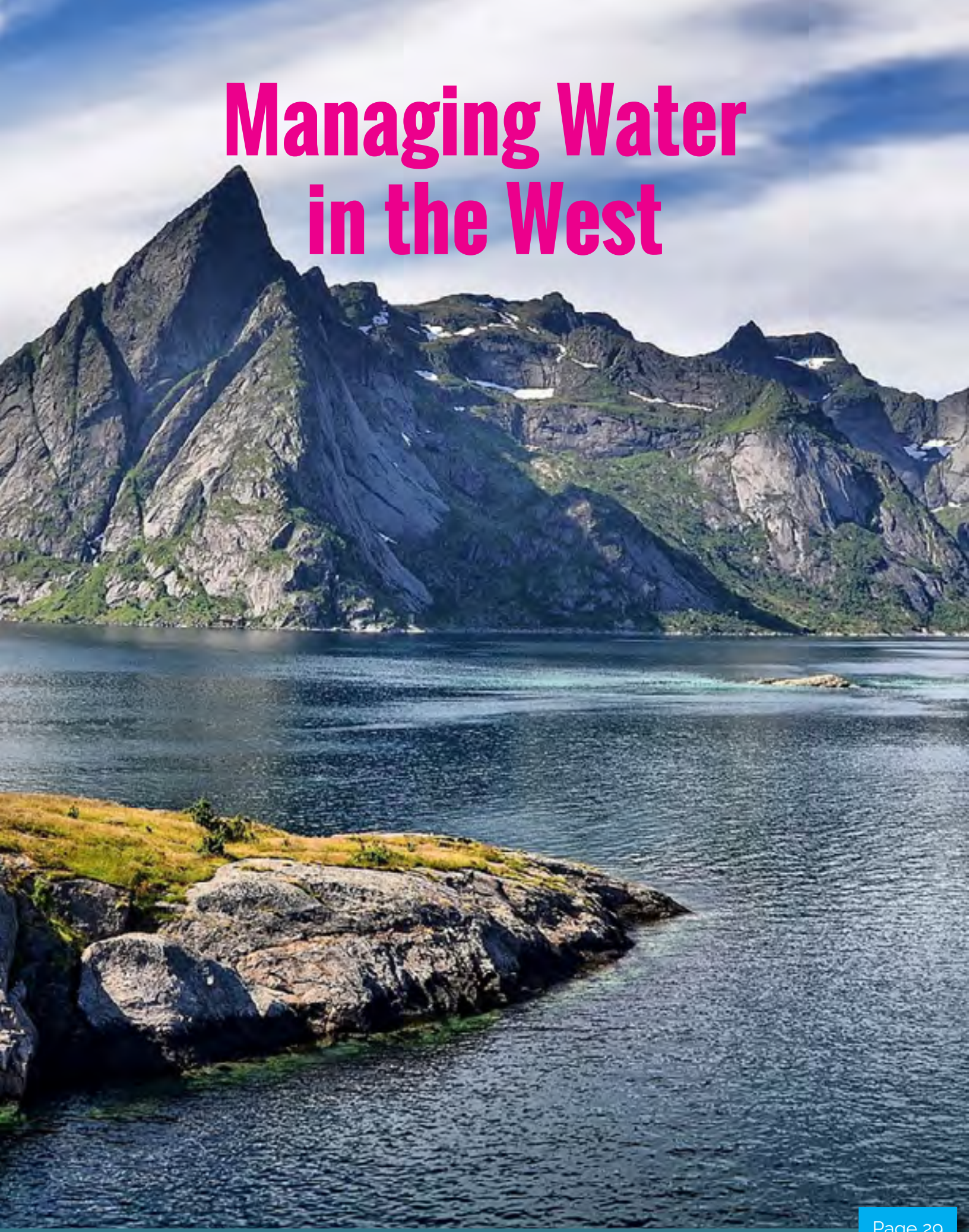
We need to drive innovation across all dimensions of the water sector: in technology, finance, management, and regulation.

We all see how science, technology, and innovation are opening new frontiers, fueling the economy, and changing our world. We must incubate this change in the water sector as well because both the challenges and the opportunities are vast.

As our nation heads into a time of transition, we need to remember that water is a nonpartisan issue. We all depend on clean and reliable water – our families, our communities, our businesses, our society."

https://blog.epa.gov/blog/2016/12/water-challenges-are-actually-opportunities/

Managing Water in the West



Water and mountains. Photo Credit: Tony

Yuliana Porras-Mendoza

Advanced Water Treatment Coordinator, U.S. Department of the Interior Bureau of Reclamation

> "I have funded individuals with stuff that came out of the garage.

We mainly serve 17 western states. We were built to bring water to the west as it was being populated. So we built dams like Hoover Dam. We also have a big production of hydro-power, the second largest in nation and make canals to deliver that water all across the states.

My little bubble in the agency is focused on water treatment. I manage 2 programs, Science and Technology, and Desalination and Water Purification Research. [...]

The Science and Technology program funded about $2 million in 2016 to do investigations and partner with people in the federal government and across government agencies to do research. In 2016 we focused on innovative technology to find solutions for an increase in water supply.

The Desalination and Water Purification Research had about $3 million in 2016. We do operate a facility so a portion of the money goes towards that, then the rest funds competitive research.

The focus of the program looks at all aspects of water treatment: wastewater, grey, surface, sea– whatever you need to treat. It is a broad program. Every year we assess the needs from industry, academia and nonprofits.

The neat thing about it is, you can only fund the best ideas that hit your table, and if I don't get good ideas at my table then I can't fund them. So your job is to give me the best ideas that you can so that I can evaluate for funding!

Grants are very cumbersome, it takes long, it takes forever. So we have been doing different things to speed up that process, and they seem to be working.

Some of the biggest projects we have within the S&T program are:

Chromium 6 removal from ion exchange,
Monitoring strategies for direct potable reuse.
Wetland research.

And some work on emerging contaminants with wastewater.

Last year we had Pitch to Pilot.

> We saw that we weren't getting a lot of entrepreneurs and small businesses submitting proposals, and we really wanted to seek some new ideas,

so what we did was put announcements out that we were providing $300k ($100k for each) and all you had to do was submit a 15 page paper that told me what your idea was–so that I could scale down the application and then select the best ones from there, pay for you to come to our facility, and sell me a pitch.

I look at what you have. What is it going to do? Can you test it? How fast can you test it? From there, we selected 3 innovative technologies that are going to be tested next year. We are really excited because they are all very different. One is for renewable energy sources; the other one is looking at biological and being very selective of what it treats–focusing on wastewater; and the other one looks at some new materials they are developing at a university.

Then you have the DWPR Program Desalination and Water Purification program which gets about $1 to $2 million a year to do funding in 3 different areas: 50/50 for laboratory scale focusing in academia, involving some of your best and craziest ideas. Then moving to pilot scale and then demonstration scale to get into market faster.

We don't only fund in the 17 western states, we are open to the whole US.

Anybody can apply to the program except federal agencies like the EPA , USDF, etc., because they already have federal funding.

So, it's open to individuals too. I have funded individuals with stuff that came out of the garage. This will be available in 2017.

For laboratory scales we fund $150k. Cost share is 50% if you are not a university. If you are a university we exempt the cost share.

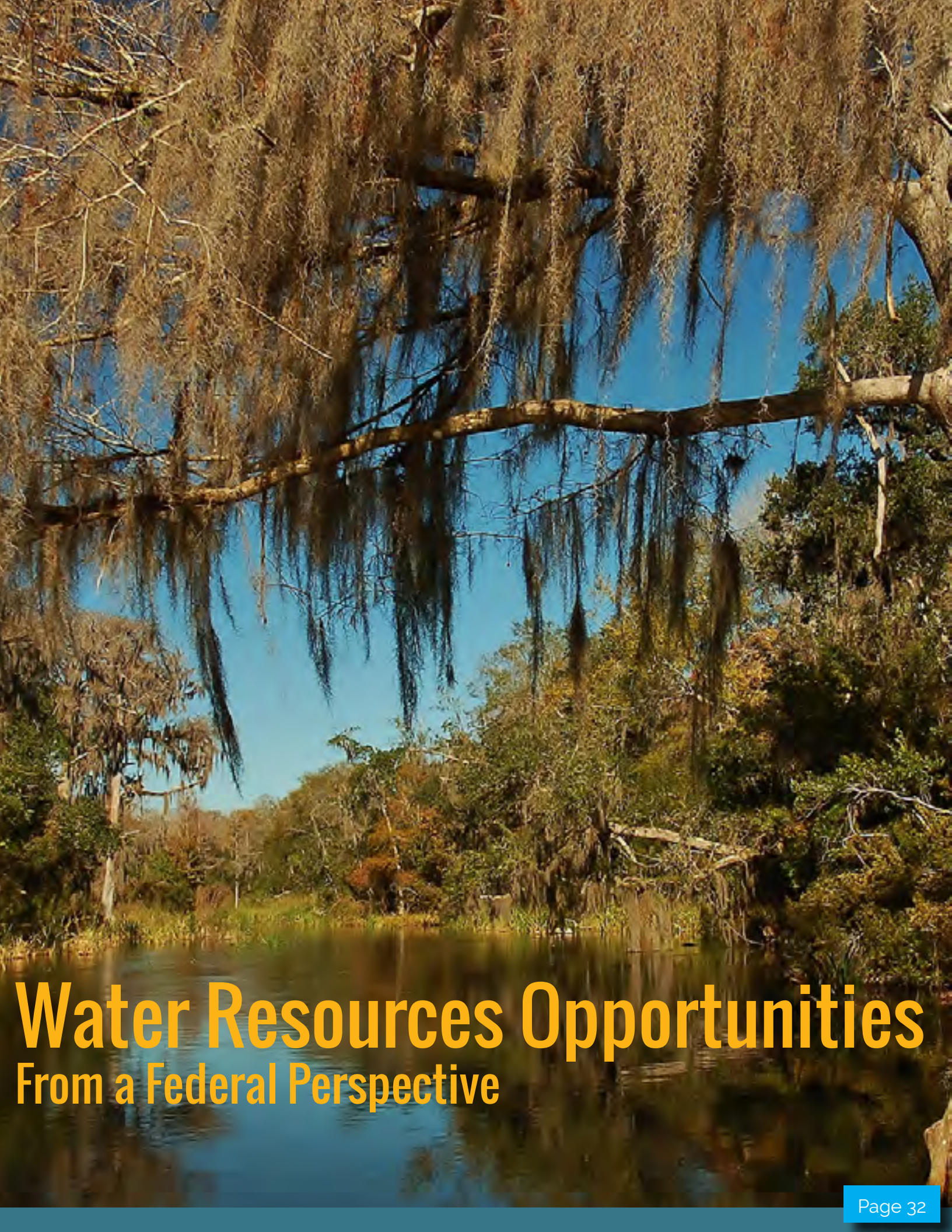
For pilot scale it is $400k for 2 years. And then full scale demonstration is $1.5 million for 3 years.

Our reclamation facilities are in Yuma, Az, Alamogordo, Mi, and Denver, Co. You can use these at no cost or very minimal cost,

depending where you are. Our water quality improvement center in is co-located with a salting plant. We have operators there who can test for you.

We just launched the concentrate prize. It's called more water less concentrate. It's $150k and the deadline to apply is march 13th.

https://www.usbr.gov/



Water Resources Opportunities

From a Federal Perspective

Dorothy Sifuentes

Senior Hydrologist, Caribbean-Florida Water Science Center

As spoken at SWRR

I am going to talk a little bit about some of the projects that we have in South Florida, but a lot of the projects we do are all over the country.

The USGS is broken into 7 different areas and the work that we do is in the water mission. The vast majority of the work that we do is cooperatively funded. There is a lot of cost sharing. We have to work with municipalities, state agencies, and federal agencies.

We get called in a lot to do science projects that may be of interest to multiple municipalities. The issues can be contentious. We are called in because we are an objective, unbiased, scientific resource.

And sometimes that means that it takes a while for us to get data out and the reason for the that is these are contentious issues and we have an extensive review process. Sometimes the review process can take as long as the research itself. This helps the public because they get science that is well-vetted.

We do surface water monitoring, groundwater monitoring and a lot of this data is up to the day, so you can go on to the endless map national water information mapper https://maps.waterdata.usgs.gov/mapper/index.html and what it does is [it] shows you an area, and you can see all of the monitoring that we are doing. It can be daily, monthly depending upon the agreement with the agency. In a couple of sites, we are starting to put in nitrate sensors.

We are also interested in groundwater salinity in South Florida.

One of the types of data that we collect is called an induction log, and we also have some salinity monitoring. This induction logging is in constructed wells and we monitor in a vertical profile where the salinity is increasing. You can see through time if the salinity is moving up. and you can see how quickly it is moving. This is a powerful tool for communities who are concerned about salt water intrusion affecting their groundwater supply.

We also have the Everglades Estimation Network which is a network of sites to predict the water levels in the Everglades, and we are expanding that to look at groundwater levels. When the water levels drop below land surface, we can get a better picture of what is going on hydrologically in the Everglades.

We do a lot of modeling. A lot of the tools that people use today, salt water intrusion, in particular, were developed in South Florida.

Another kind of modeling approach is this conjunctive use type modeling. This is a tool where you can look at the whole system in a supply and demand framework. They are using this in California. What are the demands from agriculture? Can we make it more efficient based on what we know about how much water the plants are using? It's a really interesting approach to modeling, especially in areas where you have multiple uses for competing demand. I am hoping that we can start using this approach in Florida.

We are doing saltwater intrusion modeling, where we can look at different rates of sea level rise and how that will affect the saltwater interface. This shows at different rates of sea level rise, where do we estimate the interface will be and how close is it to some of the wellfields. So you can look in cross-section where you have freshwater recharge how that is affecting the salinity interface. We also go to specific wellfields and calculate the composite salinity affects on the wellfield through time at different rates of sea level rise.

Coastal flooding is another area that we are working on.

We are innovating some modeling approaches that look at surface water and groundwater to look at vulnerable areas in the coastal parts of Florida

where they are already experiencing the sunny day flooding. The low topographic gradient, the low elevation at these high tide periods in the, Fall we are getting these inundations and [they are] made worse by passing storms or other atmosphere. So they wanted us to look at different rates of sea level rise.

The closer you are to the sea, more of that will be reflected in groundwater. So the groundwater close to the coast is going to be rising. We looked at the effects of this on the coastal drainage structures that the district manages. With rising sea levels, are they going to be able to use gravity or at what point are they going to have to use pumping to manage this? We are able to give Broward County an idea of when that transition might occur.

We are also able to go into certain neighborhoods in Broward County and say, "Suppose we want to maintain groundwater level low enough that an area doesn't get inundated by pumping, how much pumping would we have to do in a particular neighborhood in order to keep that area from being inundated?"

We are talking about some neighborhoods if you want to maintain groundwater 1 foot below land surface, you have to pump in the order of millions of gallons of water a day out.

Wastewater disposal. This is another area of great concern, particularly in the Southeast coast. Because of the permeability of the aquifer, because of the shallow water table, and the flat topography, there is not much drainage potential for reuse. So a lot of the reuse water that is being generated, there is not a lot of that can be done with it. The municipalities are looking for ways to work with partners with it. The water is not going to be transported away for reuse, they are looking at larger amounts of deep well injection to dispose of this waste. So one of the aspects that we have been critically involved with is understanding the geology. There isn't a lot of data for the deep part of the system, so we are working on a number of projects primarily in Broward and Miami-Dade.

We are using seismic reflection data. That is a type of tool that the oil companies use.

They send out a signal and receive back information that tells them what is happening below the sea surface. We are using this in canals. There are also land-based methods where we see into the sub service and where we have wells we can calibrate. We can put together a 3D map of the hydrogeology. We are doing that because the primary interest is, what are some of the areas that are maybe better or worse for injection?

One of the questions is where have some fractures or some collapsed features at depth, we are talking at thousands of feet, what's the potential if you are injecting into a certain zone of the water moving through some of those fractures and potential fluid conduits and out into and underground source of drinking water? That is a critical issue with the injecting of waste water into these deep units. What is the potential for transport into some units that could potentially be used in the future for drinking water?

We are also doing some modeling of when you inject these waters into the subsurface–what happens and how do they move through the subsurface?

The last thing that I want to touch on is water quality and, of course, nutrients. This is a big issue here, particularly in the Everglades. We know they cause all kinds of harm downstream where the nutrients are introduced into the system. This is a sustainability issue that we are involved with firstly because it involves a hydrological system, it affects some of the industries where some of these applications are, and the introduction of nutrients may not necessarily all be from agriculture.

They can also be from livestock farming or also from septic systems. Where you have older neighborhoods that are predominantly septic, those are potentially introducing nutrients into the system as well as landscaping in urban areas. So these are all things that are introducing nutrients into the system. They are mobilizing, and continue moving through the system and causing potential harm downstream. One of the areas that we are actively doing work in is looking at the hydrological system in the Indian River Lagoon to try to determine what part groundwater plays–either in transporting nutrients or refreshing the lagoon–and what are the changes that are occurring through time.

USGS science for a changing world

Denver Stutler

Breakout Session: Public-Private Solutions

Chief Executive Officer, Polston Applied Technologies

A public-private solution is a partnering for a public purpose.
Advice for P3 Success:

Follow the money. It is critical for success.
If you can't assemble a team that delivers, it dies right away.
Good leaders get stakeholder buy-in right away.
Understand the noise. Look at the symptoms, not just the cause.
Those who fail don't consider the political impact.
Respect the other person's point of view.
Be transparent. Open the kimono.
Got to get the hay down where the sheep can eat it. Everybody's got to understand it.

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Frank Bernardino

Breakout Session: The State of the State

President, Anfield Consulting

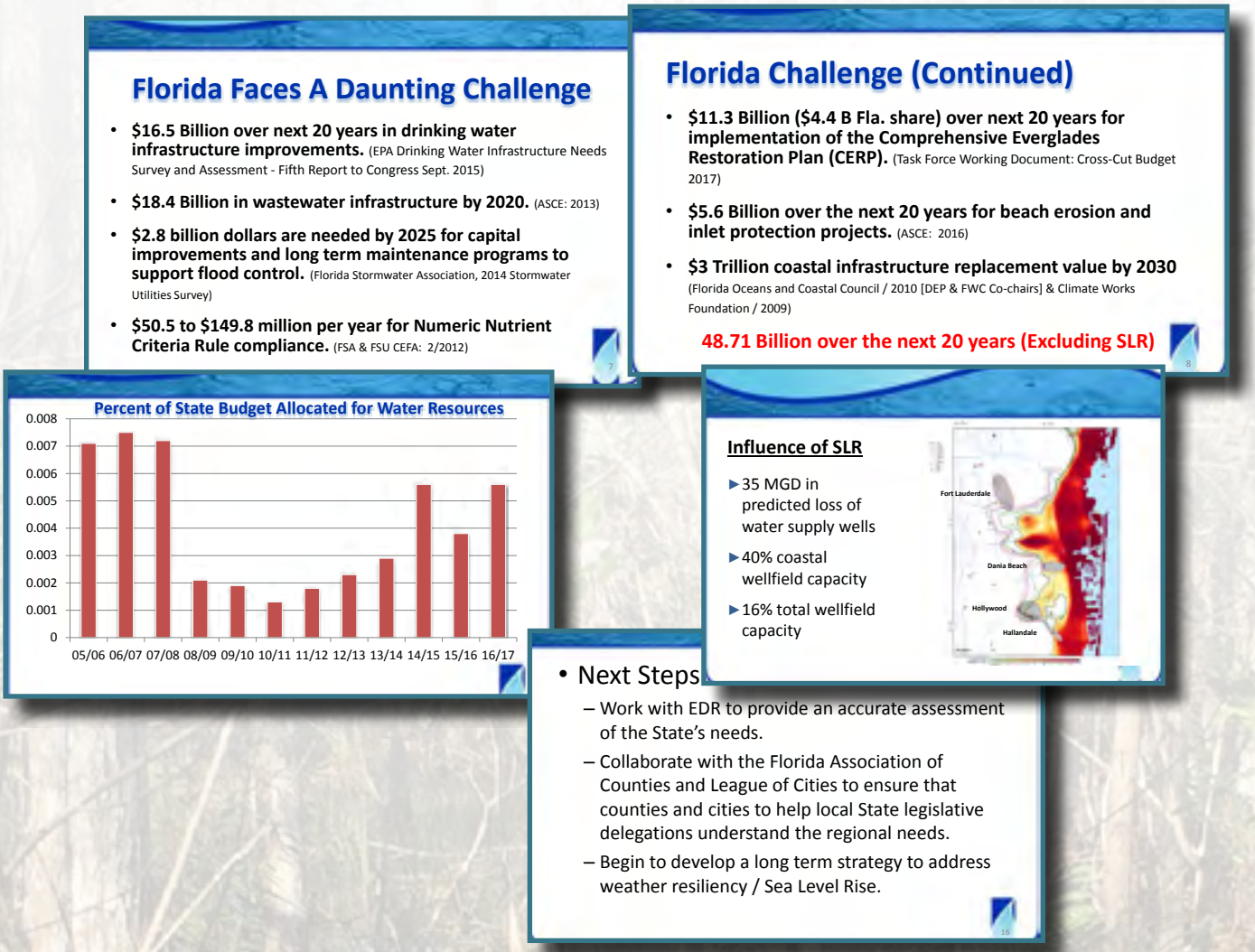
As challenges become more regional and water scarcer, communities are going to have to find new models to meet their demands. Regional and local water resource entities look at each other and ask, "Who goes first?" Institutional or historic roles impede creativity and often stand in the way of solutions. There was a time when regional agencies had money to do things, but politics have changed. Competition for limited water is a problem that is not going away.

There is an opportunity to apply ideas from the private sector. There are environmental issue leaders in the State legislature and local communities, but they need help. For example, algae in the Indian River Lagoon. Stakeholders are fighting against each other (farmers, fishermen) when they need to be working together.

Other issues, like identifying adaptation strategies to deal with sea level rise, are going to require government, academia and the private sector to come together. A university can organize and be a partner, but it cannot lead.

Resiliency Florida is working to create a space for education and partnerships. This can include entities like realtors and others in the business sector that historically have not engaged in environmental issues.

Including the private sector is the critical component to getting things done. There exists practical ways for interdisciplinary actions, but [there are] lots of barriers. The vulnerability of critical infrastructure will drive innovation. Areas of the state most effective are those that know how important investments are. Resilience Bonds are growing in popularity in Florida.



Dan Vermeer

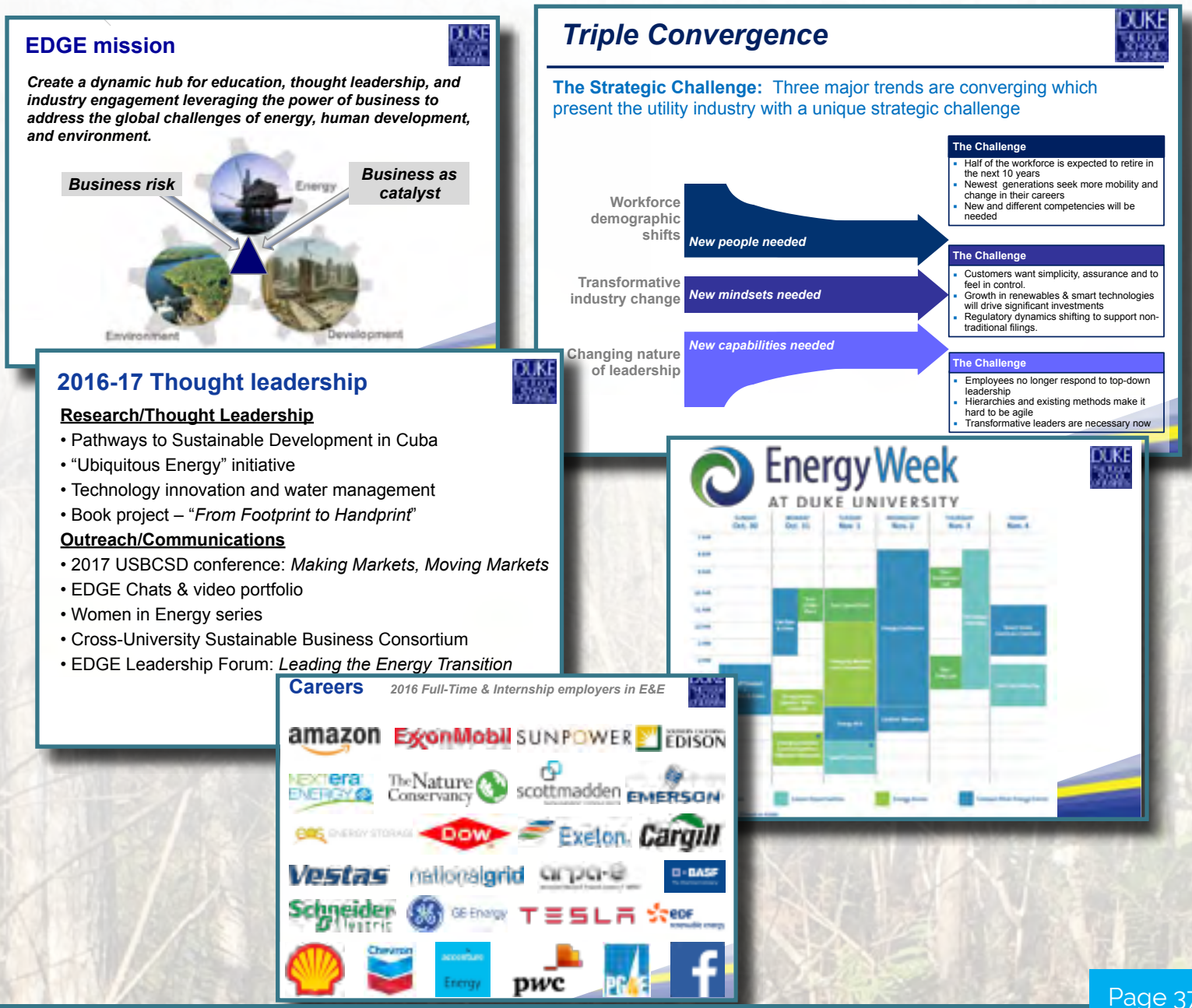
Breakout Session: Getting Value from University–Industry Partnerships

Director, Duke University's Center for Energy, Development & the Global Environment

(Paraphrased)
Points of conflict are creating risk. Global sustainability challenges such as climate, water and human rights are "wicked problems", where every solution becomes part of the problem, that is, a reconstituted problem. Universities play an important role in tackling these wicked problems through academic partnerships with industry, government, NGOs, and other stakeholders.

Research papers take years to come out. When a problem is studied, the problem moves on. So there is a big demand for experiential learning.

Duke University is seeing a massive increase in the number of students interested in learning about water and energy. Jobs weren't there for students who graduated in water, so it was successfully combined into energy. Duke now has Energy Week in which thousands of people are engaged. Women were signing up for the lower paying energy careers so Duke offers a Women in Energy series.



Tom Frazer

Breakout Session: Engaging Academia

Acting Director, The Water Institute at University of Florida

Florida's economic well-being is inextricably linked to the health of its water-dominated environment, and the legacy of our leaders rests squarely on their ability to ensure that water resources in this state are protected and conserved to meet the needs of future generations.

The UF Water Institute has distinguished itself as a leader in innovative interdisciplinary research, education, and public outreach programs. We have led the way in producing scientific research on emerging water issues and in educating the public on what they can do to make a difference.

I think that we are doing a great job, at the University of Florida, to develop the knowledge necessary to inform effective water policy and management and also doing our very best to impart that knowledge to students, the general populous, and other important stakeholder groups.

We have a tremendous capacity at the University of Florida to do this! We have hundreds of talented faculty, more than any other University in the state, working every day specifically on water-related issues... Innovating, creating and disseminating new knowledge.

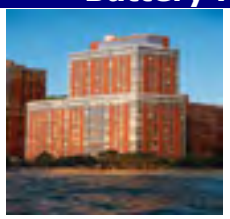
Kebreab Ghebremichael

Breakout Session: Water Management in Cities of the Future

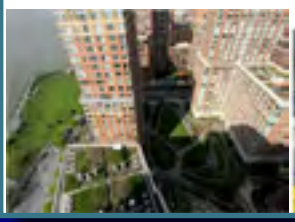
Assistant Professor, USF's Patel College for Global Sustainability

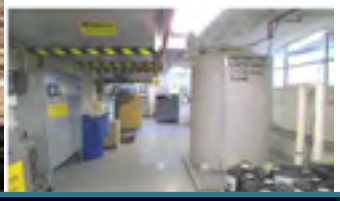
If you really want to make a significant change, you need to make a paradigm shift. There is a need to diversify our water sources. We need to move away from 19th century principles where drinking water is used for all purposes. We use water once and discharge, regulations stall innovation and are inflexible, and systems have a centralized design which is energy intensive. We are moving towards the concept of the harvesting of water.

It's already happening: Battery Park City, New York

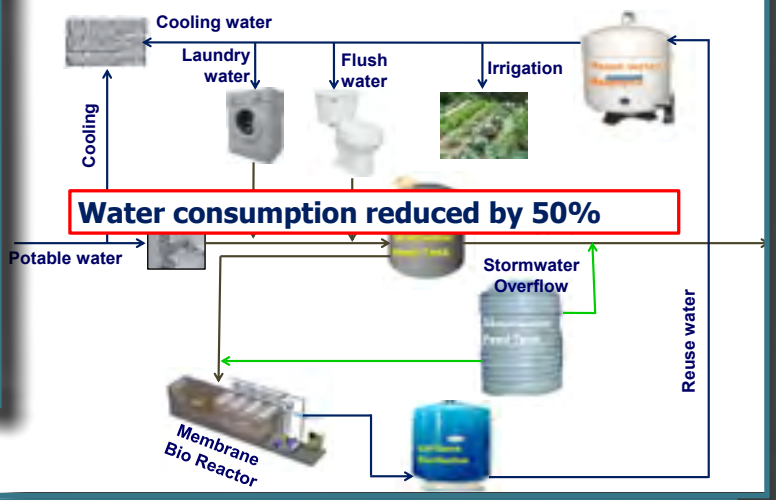


- 10,000 inhabitants
- Decentralized wastewater recycling
  - Toilet flushing
  - Cooling towers
  - Laundry
  - Irrigation
- LEED buildings, green roofs, rainwater harvesting





Water reuse scheme Battery Park



Hmmarby Sjöstad, Stockholm

Hammarby Sjöstad, Stockholm

- 35,000 Inhabitants
- Wastewater for district heating and cooling
- Water recycling

Sewer mining – Pennant Hills Golf Club, Sydney

- Sewer mining driven by water scarcity
- Frees up 80 to 100 ML per year
- Irrigated water nutrient rich
- Sydney wastewater master plan has sewer mining facilities

Singapore – Diversifying water sources for water security

Best Practices:

- Manage water supply, wastewater and stormwater holistically across institutions
- Be sure to involve all players
- Create security through the diversification of sources
- Think creatively about new water sources (and don't focus on the obvious ones)
- Fit water to its purpose. Don't use potable water for nonpotable uses
- Focus on maximizing benefits and doing more with less
- Build an adaptive system

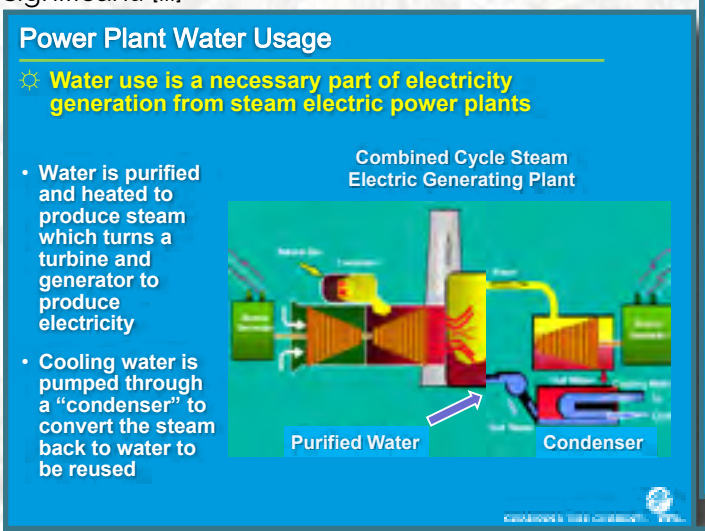
Mike Sole

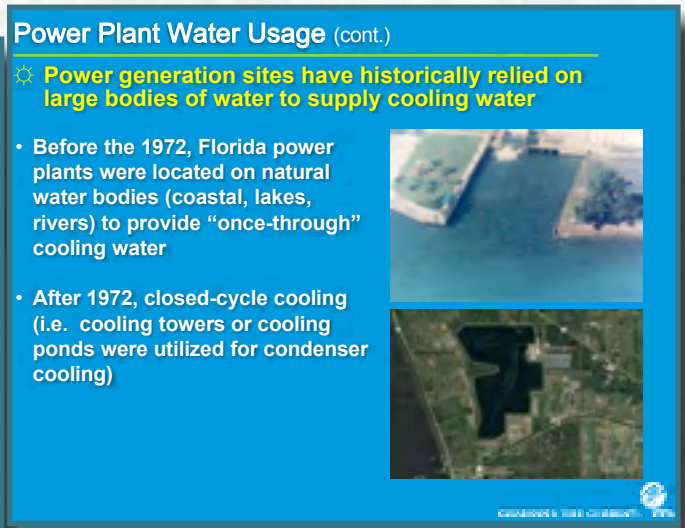
Breakout Session: The Water-Energy Nexus

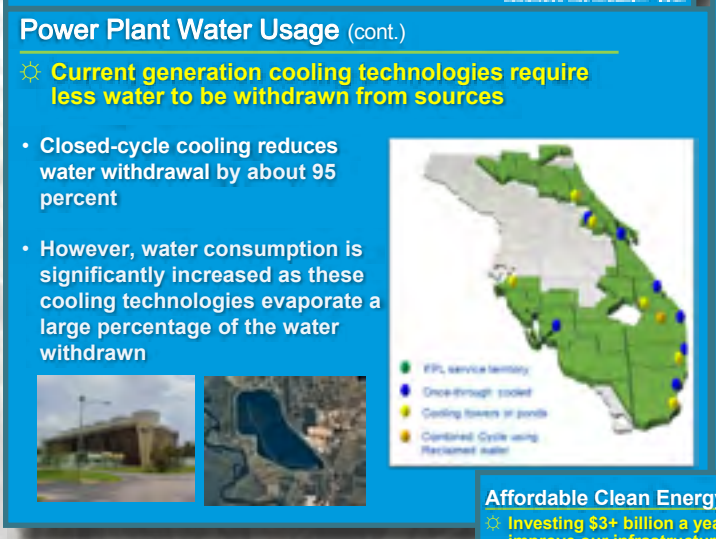
VP, State Government Relations, Florida Power & Light

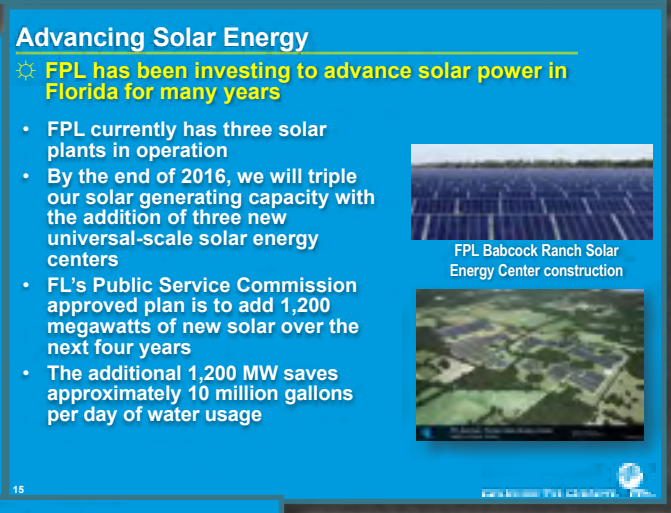
"No different than a water utility, we strive to be affordable, reliable and clean. That's our mission. Fortunately, due to innovation and investment FPL has been able to knock it out of the park on all 3 of those things. Our bills are 30% lower than the national average. Our reliability is one of the highest not only in the state but also in the nation. And the important thing that I want to talk about is our generation of emissions–we are 35% cleaner than the national average and that's primarily due to innovation and investment.

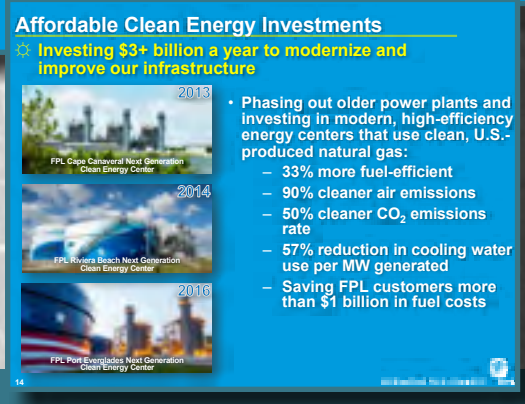
The other thing that we also look at is the water piece, and one thing that I want to remind folks of, depending upon which curve you look at, power is a significant user of water. [...] Just look at the US, when you look at coal, natural gas, and nuclear, the vast number of those generation units rely on water. So you see that globally, 85% of the nation's generation relies on steam, turban-driven electricity– which is very significant. [...]"









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Laura Herrero
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Jeffrey Lape
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Marianna Grossman, Bob Wilkinson, Chuck Drake, Cathy Johnson
Dan Vermeer
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USGS science for a changing world

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Syd Kitson, CEO, Kitson & Partners LLP
Solar Energy and Babcock Ranch - Buck Martinez, Florida Power & Light
Babcock Ranch Environmental Engineering - Amy Wicks, Kimley-Horn Engineering
Engineering Considerations at Babcock Ranch - Laura Herrero, Johnson Engineering
Public-Private Partnerships in Solving Water Challenges, Ernie Cox, Family Lands Remembered LLC
Panel moderator, Bob Wilkinson, University of California, Santa Barbara
Is Florida Ready for Direct Potable Reuse? - Chuck Drake, Board Member, Water Environment Research Foundation
Those Amazing Satellites - Cathy Johnson, Catapult Satellite Applications
Innovations in H2O Technologies - Marianna Grossman, Minerva Silicon Valley
Moderator, Sandy Wiggins, Principle, Consilience LLP
USGS - Dorothy Sifuentes, Senior Hydrologist, Florida-Caribbean Water Science Center
EPA -Jeff Lape, Deputy Director, EPA Office of Science & Technology
Reclamation...Managing Water in the West - Yuliana Porros-Mendoza, Advanced Water Treatment Coordinator, US Bureau of Reclamation
Lunch and Speaker - Peter Ward
The Water-Energy Nexus - Mike Sole, VP of Environmental Affairs, NextEra
Getting Value from University-Industry Partnerships - Dan Vermeer, Director, Duke University's Center for Energy, Development & the Global Environment (EDGE)
Public-Private Solutions - Denver Stutler, President, Polston Technologies and former Chief of Staff for Governor Jeb Bush
UF's Water Institute - Tom Frazer, Interim Director, The Water Institute at University of Florida
Florida's Water Challenges - Frank Bernardino, President, Anfield Consulting
Urban Water Management in Cities of the Future - Kebreab Ghebremichael, USF's Patel College for Global Sustainability

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