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ISSUE 1 | Summer 2016

water

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Rio's water woes

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Our Mission

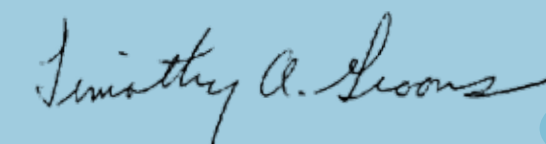
I'd like to personally welcome you to the 1st edition of **Mission: Water**, a magazine featuring the organizations and researchers tackling the world's most challenging water issues. Here we'll highlight the latest trends in instrumentation and research applications, while also offering additional educational resources on environmentally-focused matters.

Our goal is to help you stay informed about topics relevant to you. Our inaugural edition will cover articles ranging from monitoring Nepal's sacred rivers to examining coral bleaching events off the coast of Panama; research on fish diversity and nutrient recycling in Africa's Lake Tanganyika and much more!

At Xylem Analytics, we're on a *mission* to solve water-related problems all around the world. As an industry leader in providing water quality, flow and level monitoring instruments, we serve a wide range of customers that focus on surface water, ocean and coastal environments. Our commitment is to provide you with accurate and reliable instruments to equip you with the best data possible.



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Water Blogged



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Estuary Research Project Highlights Advantages of Continuous Monitoring

Researchers from the south coast of England have established a small network of monitoring instruments in Christchurch Harbour and associated rivers to study the effects of weather events on water quality, and to better understand the magnitude and spatial/temporal variation of macronutrient fluxes - nitrogen (N), carbon (C) and phosphorus (P).

The project, which is financed by a Natural Environment Research Council grant, involved the installation of three continuous monitoring stations; one in the harbor itself, a second in the River Avon and a third in the River Stour.

With over a year of data, project lead Professor Duncan Purdie says: "We were fortunate with the storms that took place over the winter of 2013/14, because we were able to gather excellent high frequency data on nutrient fluxes and water quality during severe weather, which has dramatically improved our understanding of the effect extreme river flows have on nutrient fluxes into the estuary. The monitoring systems worked very well during this period and we were particularly impressed with the performance of the EXO2 sondes and the Storm loggers."

➔ Get the full story: bit.ly/estuaryresearch



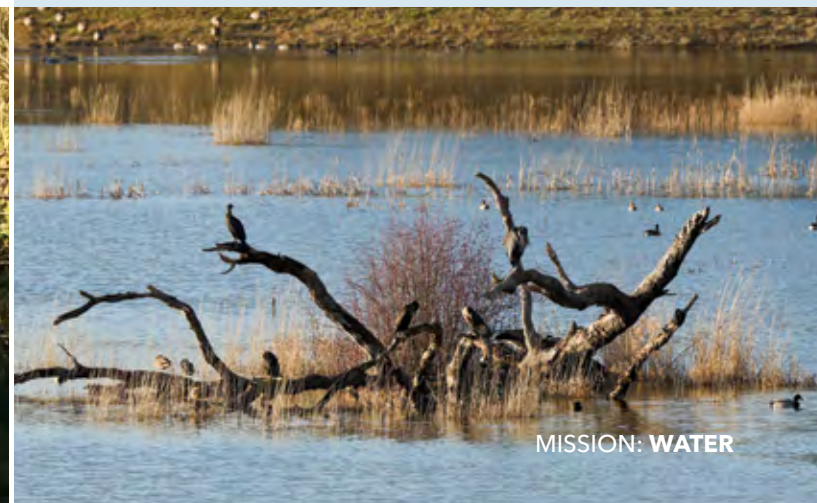
Oregon's Tualatin River: America's Early TMDL Case Study

The Tualatin River Watershed in northwestern Oregon was one of the first TMDL-regulated watersheds in the United States. Total Maximum Daily Load (TMDL) were set in 1987-88 following the resolution of a lawsuit based on the Clean Water Act. As a result of this lawsuit, a consent decree was agreed upon which included both a timetable for certain Oregon actions and a requirement for EPA action if Oregon did not comply.

Based on existing knowledge, TMDLs were set for the main stem of the Tualatin River by the Oregon Department of Environmental Quality (DEQ). Summer flow rates were averaged for the tributaries and the main stem of the river so that concentrations would not exceed 70 micrograms (0.07 milligrams) total phosphorus (TP)/L and 1 mg ammonia (total of NH₃ and NH₄⁺)-N/L. Standards were in effect only during the low-flow, warm season period, from approximately May 1st through October 31st, which covered the peak period of algal growth.

Compliance was achieved by installing nitrification ponds at the Water Resource Recovery Facilities (WRRF), which collect wastewater and allow the ammonium-N to convert to nitrate. It is important to note that since the Tualatin TMDL was established, there has been increasing interest in monitoring nitrate release from WRRFs around the country.

➔ Get the full story: bit.ly/OregonTMDL



Sharing in the love of water, join us for more stories at: YSI.com/blog

Water Quality Veteran Shares Memories and Leaves 40 Year Legacy

At the end of 2015, Mr. Mike Lizotte formally retired from his role as an Applications Engineer for YSI. Over the years he has worked with diverse groups of professionals and students on a plethora of projects – earning him a well-deserved reputation as an expert in his field.

In this post Mike shares with us how he got his start, some of his major contributions to the field of water quality monitoring, and some parting advice to the professionals of the future.

What Advice Would You Give to Up-and-Coming Water Quality Professionals?

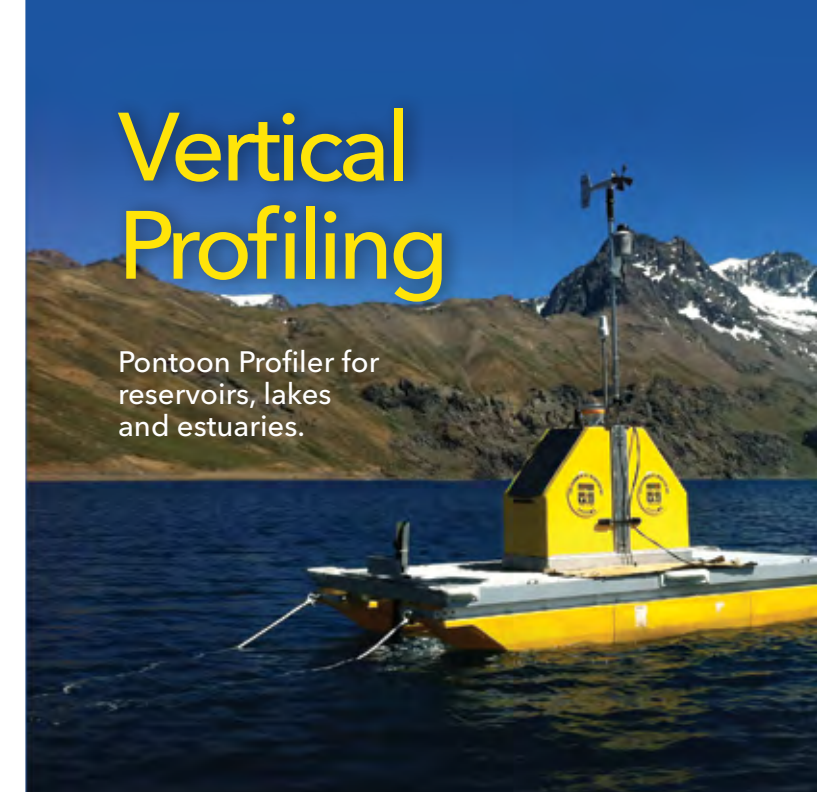
"A person in this field has to have patience – patience to learn, and patience to not expect instant gratification. In the early part of my career there were a lot of times I wanted to quit – when I had to do a job I didn't like. And yet, I learned from that and it prepared me for new jobs down the road. For some people, they are less willing to stick it out. Some of that has to do with the fact that many folks have very large education bills that need to be paid, rather than sticking it out in a field they love they will jump from position-to-position to climb the revenue ladder."

➔ Get the full story: bit.ly/waterqualityveteran



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ADVENTURE CENTRAL

“When I was a kid, my mother told me not to go in the creek. These kids are taught the same thing. Now it’s, please, jump right in.”



RAYMOND MAHAR
UD River Stewards

The American education system consistently receives criticism aimed at early childhood development. The common perspective is that our schools are simply not working. Children are incapable of scoring well on standardized testing, ill prepared to apply to college, and lack the 21st century skills to function in our world today. Look at the statistics, and the future seems truly daunting.

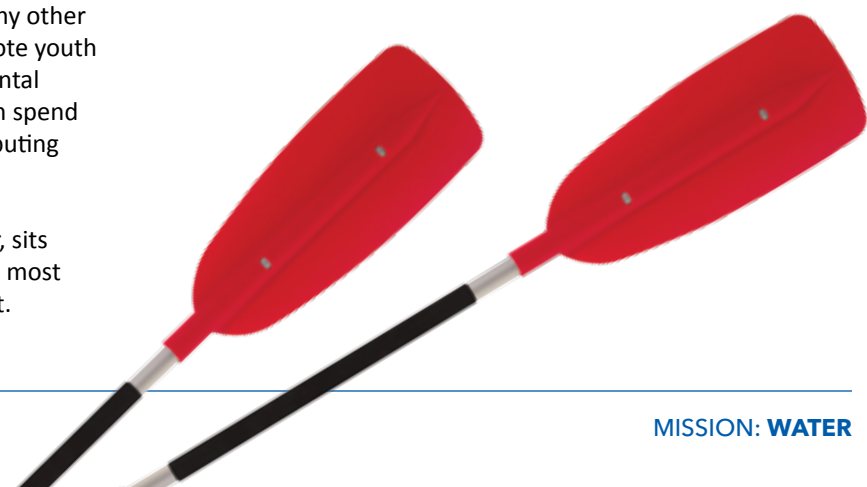
Let’s take a step back. Before we emphasize numbers and formulas, what do we remember as the most crucial time in our young lives? If you take a trip to Adventure Central at Wesleyan MetroPark, they’ll tell you it was the experience of play. Games of four square, tag, and kickball encapsulated our summers as kids. The site is located in Dayton, Ohio and offers an after school education program far different than any other in the area. The education center’s mission is to promote youth development and leadership skills using an environmental foundation in a welcoming, safe, and fun setting. Youth spend time connecting with nature to enable them as contributing leaders for the future.

Wolf Creek, a major tributary of the Great Miami River, sits in Adventure Central's backyard and is regarded as the most beneficial resource the site utilizes. And the kids love it.

“Kids feel a natural connection to the river. They are drawn to play in the river, and the relationships and confidence gained from that are great,” says Center Director and Extension Educator Nate Arnett.

Adventure Central students are mainly comprised of Dayton's inner city youth. Most families come from low-income households, several having little opportunity for such an experience with the outdoors. When kids come here, they explore the woods for the first time, learn about plant life, and roast their very first marshmallow. Those initial experiences are extremely powerful at such an impressionable age, and the river exponentially adds to their fun at Adventure Central.

“When I was a kid, my mother told me not to go in the creek. These kids are taught the same thing. Now it’s, please, jump right in,” says Program Coordinator Angela Collie.



The students at Adventure Central are realizing everything the river can offer. Groups explore the creek for macroinvertebrates, and even engage in water testing with adult leader assistance. They have taken ownership of the site, as the colloquial name for the river has become “the beach.” Their imagination is released during their time on the water. Kids are allowed to explore, build, and swim to their hearts’ content.

It’s truly liberating.

Adventure Central holds programs all year long, including a day camp in the summer. It is during this time the kids engage with “river gods”, as Arnett calls them. These individuals are the River Stewards, a University of Dayton student leadership group that promotes civic engagement and service. Each summer, the Stewards volunteer and bring kayaks for the kids to try. It’s not a secret - the kids love paddling around in the kayaks.

“I had a lot of fun kayaking. I was really good, except when I ran into a lot of rocks,” says ten-year-old participant Jayla Fields. There’s a definite uncertainty when kids hop into the kayaks. Arnett describes the initial feeling as a “healthy fear.”

Kids embark on new experiences, overcome challenges, and have fun. The River Stewards and Adventure Central Staff form relationships of trust and support with the kids.

“The kids at Adventure Central taught me what it meant to be a kid again. I was there to teach them about the importance of their creek. Instead they showed me the importance of their creek through their laughter and smiles we shared together,” says River Steward, Boyd Newman-Caro.

Every day these kids go to school and hear the same lesson; score this high, learn this formula, and spell this word correctly. At Adventure Central, there is not one correct way to do things. Failure is welcomed and seen as an opportunity to learn. The outdoors and the river offer the necessary tools to enable these kids as imaginative and innovative thinkers. Through their activities the children learn leadership skills and teamwork. In every aspect of environmental youth development, Adventure Central is succeeding.



SACRED STREAM

FLOWTRACKER HELPS NEPAL RIVER EXPEDITION

◆ STEVE WERBLOW

The Bagmati is both a sacred river and a city sewer, running through Nepal's capital city of Kathmandu before heading into the mountains and over the Indian border. Since 2013, thousands of volunteers have gathered along the Bagmati for weekly river clean-ups on Saturday mornings, and the 100th cleaning event on April 11, 2015 drew more than 100,000 locals to the river's banks.

The next day, a group of students and hydrologists embarked on a 10-day, 160 km (100 mile) hike along the Bagmati from Chovar—the point where the river leaves the Kathmandu Valley—to the Indian border. Sampling every 5 km along the route, where the landscape permitted, the UK-based Biosphere Association and Kathmandu's Nepal River Conservation Trust made the first openly available survey of the downstream effects of Kathmandu's pollution in the Bagmati.

The expedition was a massive undertaking, both physically and logistically.

"It was sort of the Nepalese river equivalent of going up one of their mountains," marvels Lee Pimble, European Hydrology Manager for Xylem Analytics, who traveled to Nepal to train the team on hydrometric sampling at the request of organizer Carol Milner, founder of the Biosphere Association.

"It was...the Nepalese river equivalent of going up one of their mountains."

SonTek European Hydrology Applications Manager, Lee Pimble, conducts acoustics training for volunteer researchers working for the Nepal River Conservation Trust.

Local Heroes

Milner, who is based in the U.K. but has many friends in Nepal, was touched by the impact of pollution in the Bagmati—particularly on its impact on poor residents, who cannot afford clean water but also can't rely on the fouled river to supply their needs.

In 2010, she asked a local when the trash in the river would be removed, and was told that the monsoon would soon wash it to India. That was the last straw.

"I wanted to give assistance to those already fighting to make a change for the future," Milner says.

Delving deeper into the challenges facing the Bagmati, Milner found that water levels in the river were dropping precipitously. Rock mining was altering the porosity of the substrate and changing the flow of the water table. Draws for growing communities, irrigation and industry decreased river flows, and some studies indicated that recharge was decreasing.

Local hydrologists needed data on the river's flow to create a baseline along the river, explore changes in pollution and fill in blanks in hydrological station readings that are vital to understanding flood risk in the river's basin.

"Milner...was touched by the impact of pollution in the Bagmati – particularly on its impact on poor residents."

Donated FlowTracker

In her native England, Milner approached Lee Pimble of Xylem for help. She was hoping to borrow or buy a FlowTracker handheld acoustic Doppler velocimeter (ADV). Built by SonTek, a Xylem brand, the FlowTracker is a rugged, compact instrument that would be ideal for the challenges ahead and would allow the group to measure the velocity, direction and discharge—or volume rate of water flow—in the river.

"We knew the expedition would be tough, walking remote terrain, and wanted something that would be reliable," Milner explains. "Although we had a small budget, we contacted SonTek, mostly for advice at first. Lee Pimble was extremely helpful and engaged in our plight, and his advice was not based on sales, but on actual river experience."

Pimble requested permission from headquarters to lend an instrument to Milner or find a demonstration model to sell her. His pitch excited the product team, and Pimble was told SonTek would donate a brand-new FlowTracker instead. At Milner's request, Pimble agreed to travel to Nepal to teach the Nepal River Conservation Trust team how to use the instrument.

"This was the perfect opportunity to put our technology to work, using science in a very practical way to help solve environmental challenges," explains SonTek product manager Janice Landsfeld in San Diego, California. "We could put a powerful tool in the hands of a really committed group of people halfway around the world and help them in their efforts to rescue their sacred river."

Fast Training

Pimble says he was concerned at first about training the group to use the FlowTracker. The Nepal River Conservation Trust team was comprised of a group of enthusiastic, young hydrologists and ecologists. Some had masters degrees and field experience. Others were undergraduate students, eager for real-world experience and committed to working their way into the conservation world. But most had been trained in Nepal, a poor country where even the top government agencies were measuring flow with outdated mechanical equipment.

"They had no knowledge of the acoustic instrument," Pimble says. "But they took to it. Considering they were novices with the technology, they were very quick [to learn]. We spent half a day ensuring that they understood hydrometric techniques. Once they grasped that, we were probably an hour in the field using the FlowTracker before I was comfortable saying, 'go ahead' and they were on their way."

Location, Location, Location

In fact, says Pimble, most of his two-day training session focused on site selection, not equipment operation.

"The FlowTracker allows them to follow a very straightforward, step-by-step procedure," he notes. "If you follow the FlowTracker, step-by-step, you will get good results. But if you don't choose a good sampling location, you won't get a good measurement, no matter what instrument you have."

Pimble points out that the FlowTracker allowed the Nepal team to measure water where velocity and depth were well below the thresholds of old, mechanical meter technology. That permitted far greater breadth in site selection and the opportunity to build a much more comprehensive picture of conditions in the river.

"We went to the river and tried different scenarios," Pimble adds. "We looked at velocity distribution and how that affects the measurement. We looked at debris in the channel. In the UK, when we think of 'debris,' we think of vegetation. In Nepal, it could easily be a dead goat or maybe pieces of a car. It could be anything. By the third day, we worked at some interesting sites. They practiced keeping themselves safe in the water, and not so much on the use of the instrument."

With Pimble's training course and a few hours of experience in the river, the group headed down the valley to begin their expedition, toting the compact FlowTracker.

"They were walking the whole stretch," says Pimble. "They carried everything—the FlowTracker, the rod, the batteries, their food, the water quality equipment. Everything."

The physical challenges of operating on foot made the FlowTracker's reliability as vital as its portability.

"Because we were hiking in remote areas, it was difficult to re-measure a site," Milner points out. "It would have involved hiking 10 or 20 km back to it, so the immediate feedback of the system to look for potential errors was vital."



Cremation ceremony along the holy Bagmati River at Pashupatinath temple.
Photo: De Visu

Tragedy Strikes

As the Bagmati team began its hike back to Kathmandu the ground shook from an earthquake that registered 7.8 on the Richter Scale and devastated the capital and the surrounding area. In a matter of moments, hundreds of thousands of people were left homeless. The quake injured approximately 22,000 people and killed nearly 9,000, including friends and family of some of the members of the hydrology team.

Pimble, back home in England, started calling his new friends in Nepal to check on their safety, and immediately began sending money to first-response groups. Meanwhile, Xylem mounted a company-wide campaign through its foundation, Xylem Watermark. Employees donated more than \$25,000; the company double-matched the gifts and added a corporate contribution of its own, amassing a total donation of more than \$218,000 to Mercy Corps' Nepal operations.

"The work we do is about more than projects and data," says Landsfeld. "It's about the people we work with, the bonds we create, and the passion we share for environmental work. Xylem's response to the earthquake in Nepal, through the individual generosity of our colleagues like Lee and the company's contribution, reflects that personal concern and connection."



KATHMANDU, NEPAL - APRIL 29, 2015: Patan Dubar Square which was severely damaged after a major earthquake.
Photo: Shutterstock

Future Goals

Using the lessons learned along the Bagmati, Milner is planning a similar expedition along the Karnali River, a major tributary of India's famous Ganges.

The Karnali team will use the FlowTracker to measure discharge of many tributaries to the river, Milner says, and is exploring ways to use the instrument from a raft to measure flows in the main stem. The FlowTracker is also at the heart of a program led by a former member of the Bagmati team to train and inspire Nepalese university students, giving them an exciting chance to use top-shelf hydrology tools and techniques.

As Nepal engages in the long, difficult process of rebuilding the nation in the wake of the devastating earthquake, Pimble remains in touch with his colleagues in Nepal. He says he's confident the Nepal River Conservation Trust team will persevere in its efforts to clean up the Bagmati with the calm, grace and grit he observed when he visited on his training mission.

"They're going to carry on," he says. "The earthquake put them back, but they are still trying to do their work of restoring the river. They're that sort of people."

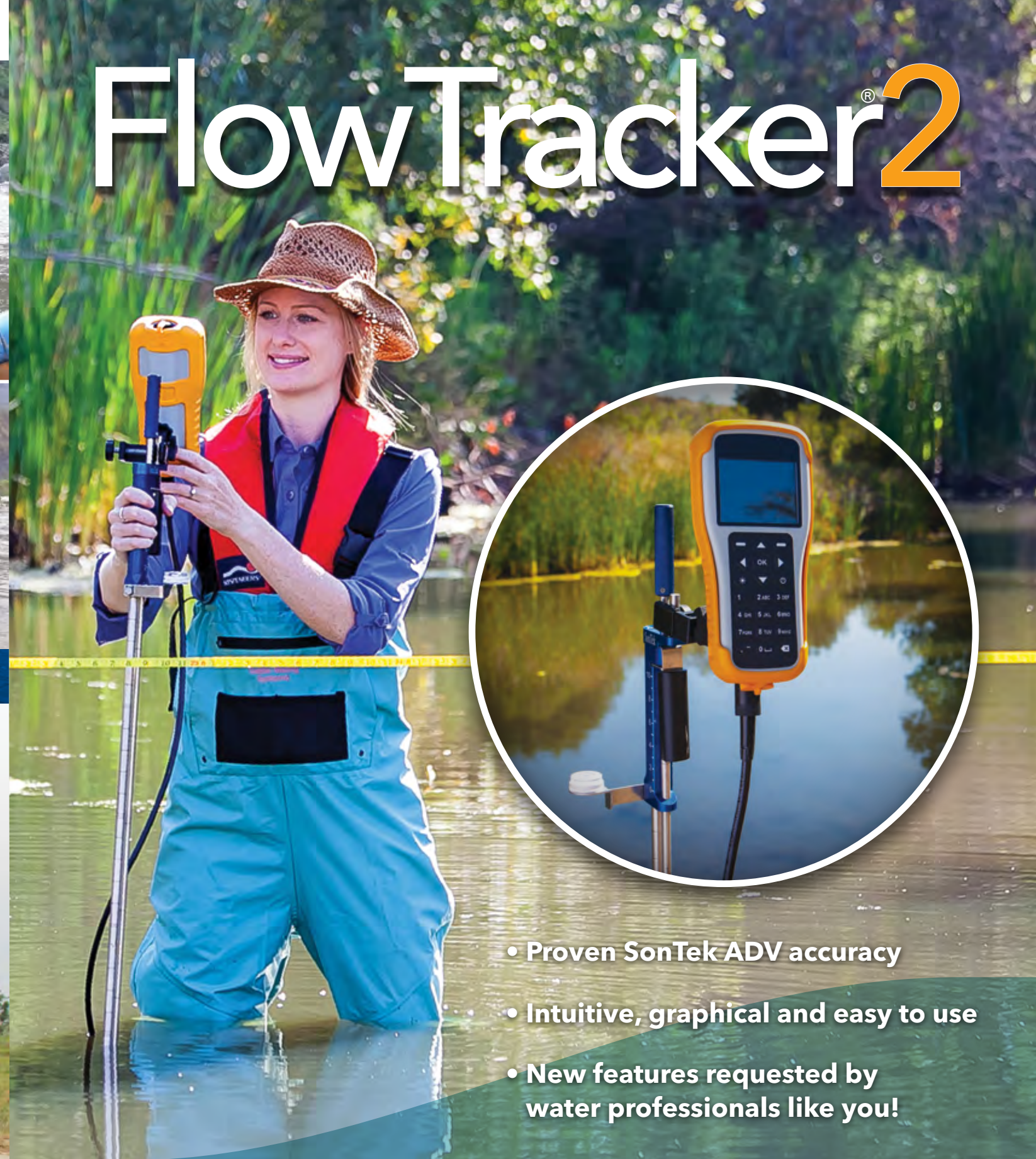


Photo of the expedition team.
Courtesy NRCT



Expedition team members collect flow and discharge data at cross sections along the Bagmati river. Courtesy NRCT

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Lake Tanganyika

Fish Diversity, Nutrient Recycling and Periphyton Productivity in the Littoral Zone

Dr. YVONNE VADEBONCOEUR
 Department of Biological Sciences,
 Wright State University



Lake Tanganyika in East Africa is the second deepest lake in the world reaching a maximum depth of 1,470 m (4,820 feet) and is also the second largest lake by volume. The lake is divided among the countries of Burundi, Democratic Republic of the Congo (DRC), Tanzania and Zambia. Most of the lake's massive volume of water sits in its dark depths, where a lack of oxygen makes it impossible for fish and other animals to live. But swimming near the well-lit shoreline is one of the most diverse freshwater fish communities in the world. The lake supports nearly 275 fish species, many of which are endemic and are popular aquarium pets. In fact, nearly 98% of the Tanganyika cichlid species are found nowhere else.

RUMONGE, BURUNDI
 People collecting water from Lake Tanganyika in Rumonge
 Photo: Giulio Napolitano

The littoral (nearshore) ecosystem of Lake Tanganyika is the freshwater analog of a coral reef. The clear, shallow waters at the lake's edge are low in nutrients, but the attached algae (periphyton or microphytobenthos) are highly productive and support the diverse fish community.

Dr. Yvonne Vadeboncoeur (Department of Biological Sciences, Wright State University) and Dr. Peter McIntyre (Center for Limnology, University of Wisconsin) are studying the relationships between fish abundance, periphyton productivity and nutrient upwelling in Lake Tanganyika. They are exploring the key roles that grazing and nutrient excretion by fish play in maintaining high ecosystem production.

For years, lake ecologists have assumed that phytoplankton, or algae in the water column, are the main source of primary production in lakes. However, evidence is accumulating that in lakes of all sizes, periphyton forms the energetic base of littoral food webs. Furthermore, the vast majority of fish species in lakes feed in the littoral zone. In doing so, the fish rely on periphyton for energy, either through direct consumption, or by consuming invertebrates that graze on periphyton. In Lake Tanganyika and other African Rift Valley lakes, the majority of the fish species are grazers and consume periphyton directly. Therefore, periphyton productivity is critical to understanding littoral ecosystem dynamics. But quantification of the role of periphyton in the lake ecosystem has been hampered by logistical constraints associated with measuring periphyton productivity.

Chamber methods for measuring phytoplankton productivity are well-established and usually include the use of ¹⁴C to measure carbon uptake. In contrast, benthic primary productivity is not a routine measurement in lakes. Initial methods also used ¹⁴C, but it became increasingly obvious that benthic biofilms have high productivity rates. The high photosynthesis rates made bulk oxygen exchange methods a viable alternative to tracer methods.



East Africa and Lake Tanganyika from Orbit
Photo: Anton Balazh & NASA

Periphyton on rocks or intact sediment cores are easily isolated in chambers. Large changes in oxygen in light and dark chambers can be detected over short incubation periods (15 minutes to 2 hours). The tricky part is getting an accurate oxygen measurement while, at the same time, preventing exchange with the atmosphere. Agitation of the sample introduces error.

Stirring is not required to make accurate measurements of oxygen with the YSI ProODO, and the ProODO has increased both the speed and repeatability of the benthic primary productivity measurements. Intact periphyton communities are incubated in chambers, either in situ or under lights in the lab. Immediately before withdrawing a water sample, the water is stirred in the chamber with a built-in rotatable paddle or the entire chamber is rotated to mix the water.

No air is in the chamber, so this procedure breaks down any oxygen gradients in the chamber without introducing air that would affect the readings.

Water samples are then withdrawn using a disposable, needle-less, 60 cc syringe. The entire syringe is filled with water, and extreme care is used to prevent the introduction of any air into the syringe. After the syringe is filled, a small rubber cap is placed on its terminus.

After the diver returns to the surface, the internal plunger of the syringe is carefully removed, and replaced with the ProODO optical-based dissolved oxygen sensor. The stainless steel probe guard that protects the optical sensor fits perfectly inside the syringe, and it holds the sensor in the center of the water sample.



The majority of Lake Tanganyika's fishes, like this *Tropheus duboisi*, live along the lake's well-lit shoreline boasting one of the world's most diverse freshwater communities.

In approximately 40 seconds, researchers have an accurate oxygen measurement. This technique is very fast and allows for many more measurements than previous methods. The ability to make a high number of replicate measurements addresses the common concern of high spatial heterogeneity in periphyton biofilms.

By measuring benthic primary productivity and nutrient uptake in Lake Tanganyika, researchers are beginning to understand how this ecosystem supports so many fish.

The fish persistently graze the periphyton, and the water itself is extremely nutrient poor. The biomass of the periphyton is incredibly low, but data from the measurements demonstrates that the algae on the rocks are incredibly productive.

How does such high productivity and diversity persist in the face of apparent extreme nutrient scarcity? It is believed the answer lies in the grazing fish themselves. Most of the nutrients in the system are actually in the bodies of the fish. By staying in the surface waters and feeding on algae, the fish keep the nutrients in the lighted waters where the algae can use them. The fish continually excrete small amounts of nutrients as waste products, and this helps maintain high algal productivity.

Ongoing lab and field experiments are helping us to understand the mechanisms underlying the high ecosystem production and high fish diversity in Lake Tanganyika.



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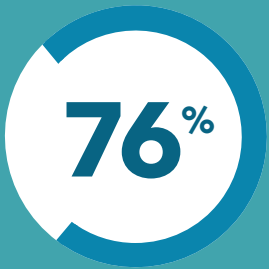
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DROUGHT-WEARY CALIFORNIANS ARE READY FOR RECYCLED WATER*

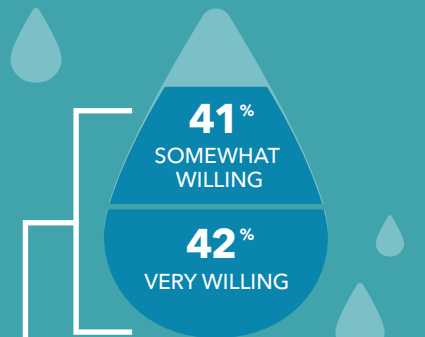
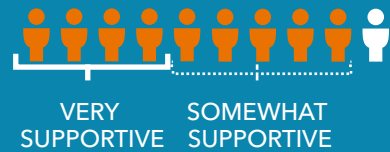
Residents eager for long-term solutions to water scarcity



of survey respondents believe recycled water **should be used** as a long-term solution, regardless of drought.



of respondents **SUPPORT** using recycled water as an additional source of water.



83% are **willing to use** recycled water in their everyday lives.

Californians believe that recycled water should be used as a

LONG-TERM SOLUTION

for a water-secure future - regardless of potential rainfall from El Niño.



NEARLY 90%

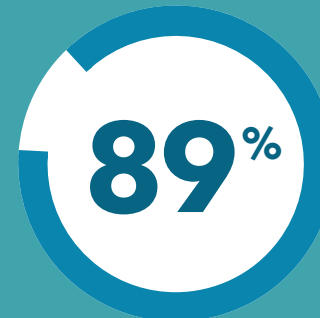
of Californians believe the state should **continue to invest** in recycled water for drinking water even if El Niño brings the expected rainfall.



Only **12%** will be less concerned about conserving water if El Niño brings the expected rainfall.



EDUCATION is a **key component** in securing support for recycled water across the state.

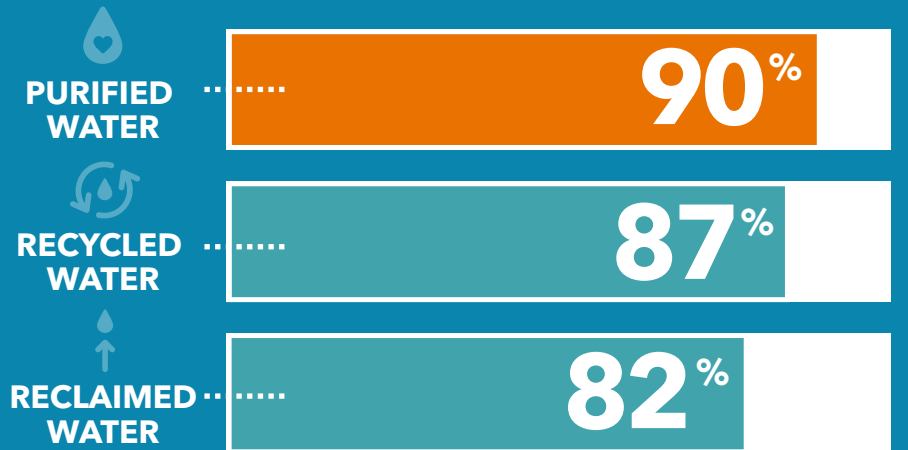


of California residents are **more willing** to use recycled water after learning about the treatment process.



LABELS MATTER:

Referring to reused water as "**purified water**" garners stronger support for its use as an additional local water supply than "**recycled water**" or "**reclaimed water.**"



of Californians agree that the drought has made them **more supportive** of **RECYCLED WATER.**



Californians are **READY** for recycled water. The state has the opportunity to **LEAD** the US in accelerating the use and acceptance of recycled water.

xylem
Let's Solve Water

*These results are based on an online survey by research firm Edelman Intelligence of approximately 3,000 randomly selected California voters from January 14-30, 2016. The survey was commissioned by Xylem Inc. and has +/-3.1 percent margin of error.

Flow for the Future

Chinese officials take action, through water level data, with early warning and flood prevention.

🌊 EMILY JENSEN



Central China Floods, 1931
Davies, Richard

Millions Lost in Flood

In 1931, among the plains of Southeastern China, the Yangtze River water level peaked due to torrential rains, flooding nearly 500 square miles of the surrounding area. This historic, devastating flood killed 3.7 million people. Farm land and rice fields were swamped, destroying a major food source for citizens in surrounding cities. As a result, many suffered from starvation and disease.

The flood was arguably the worst natural disaster in over a century.

Dam Proposed For Protection

Sun Yat-sen, founder of the Republic of China, proposed a Dam in 1919 to protect the river communities.

Though construction on the Dam was not yet started, it became a controversial topic among many. Environmentalists cautioned that the Dam would take a toll on the surrounding ecosystem and provide future problems. Planning and implementation of the project was stopped by government officials during the Chinese Civil War in 1947.

In years to follow, extensive flooding continued to occur along the Yangtze river, causing more death and costing billions of dollars in damages.

In the 1980's, the idea of the Dam resurfaced. The Dam and reservoir design would protect residents from flood conditions, provide fresh water for agricultural use, and be a source to generate electricity without greenhouse gas emissions. After much debate, construction started in 1994 on what is now known as the world's largest hydroelectric dam, spanning 1.4 miles (2.3 kilometers) and 607 feet (185 meters) tall—The Three Gorges.



The Three Gorges Dam, one of the world's largest, on the Yangtze River, Hubei Province, China.
Photo: SINITAR

Facing Drought - Nearly 100 Water Monitoring Sites Installed

Years later, in 2011, the environmentalists' nightmare came true. Southern China was facing the worst drought China had seen in 50 years.

The Dam faced criticism from environmentalists, who blamed the Dam for causing the drought by storing water upstream for power generation. Critics argued that the annual filling of the Three Gorges Reservoir caused plummeting water levels downstream, resulting in two of China's largest freshwater lakes, Poyang and Dongting, to diminish.

Regardless of the droughts cause, Chinese officials took action—installing nearly 100 water monitoring sites along the Yangtze River.

Continuous, water quantity monitoring sensors installed at these sites provide important information to help manage the drought, provide early warning for future flooding, and assist in power generation at the Dam. A H-3553T bubbler from YSI, a Xylem brand was installed to gather stage and flow measurements that help officials accurately monitor the water level of the river, above and below the Dam.

Water Level Data is Vital

It is important to monitor the water levels above and below the Dam for a number of reasons—including public safety, environmental impact, and generation of electricity.

“The sensors from the monitoring sites provide key data to help the Three Gorges Cascade Dispatch Center and Changjiang Water Resources Commission,” states Roger Zhou, Xylem Analytics representative. “The Changjiang Water Resources Commission, can then build a regional water flow model, which is used for power generation estimation and to calculate storage capacity of the Dam”.

The reservoir is said to be able to hold water at a maximum height of 574 feet (175 meters). Officials analyze the monitoring data to determine if they need to discharge water to prevent flooding upstream.

In addition to the risk of flooding upstream, data is also used to prevent downstream flooding.

“If the reservoir is filled, there is no room to catch and hold water if there is a flood,” explains YSI Water Level Division Product Manager, Tim Jeppsen. “If a big storm is coming they need to know if there is capacity in the reservoir to hold water so the area below the dam is not flooded”.

Managing for Millions

The water level data is also used to assist in the balancing act of providing water both above and below the Dam. Holding the water upstream, when it is needed downstream can have a negative environmental impact downstream—causing drought conditions which can in-turn affect farmers and water transportation.

“The monitoring data also helps officials to redirect the water to cities where residents are experiencing shortages downstream,” adds Jeppsen. “Managing the water level data directly affects the lives of citizens both upstream and downstream from the Three Gorges Dam”.

“ The sensors from the monitoring sites provide key data to help... build a regional water flow model. ”



MISSION: WATER

One of many monitoring stations built along the Yangtze.

NEW

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YSI.com/Amazon

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*Shown with optional display.



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Marine Search and Rescue

Helping local police and fire agencies all over the world to better their search and recovery operations.

JUDY BRAGG & BRITTANY DANEK



Police officers and firefighters have tough jobs.

Their duty to protect and serve local communities isn't limited to catching the bad guys and putting out fires. Not anymore. These days, their job descriptions seem to extend for pages on end; from investigating crimes to providing first aid. Over the past several years, "side-scan sonar technician" and "hydrographic surveyor" have even been added to this long list.

Since time is always crucial in search and rescue operations, real-time sensors and navigational charts have become critical tools to find missing people or evidence lost in marine environments.

Long gone are the days of relying solely on teams of divers to sweep an area during surveys. New technology is improving the safety and efficiency of these types of investigations.

In the past, marine searches by police or fire departments would be conducted by trained divers swimming in one of several patterns (Ace, Parallel, Circular, Linear, and Grid). The team would swim along the bottom of a lake, river or coastline, with guidance from partners above water to ensure a thorough review of an area. This tedious process could take hours to fully explore even a small space.

Nowadays, a combination of powerful sonar systems and software platforms help divers quickly discover their targets. This technology provides real-time images of a sea floor or lake bed, even when darkness or murky waters would otherwise affect a dive team's visibility.

Search and rescue teams are now exploring larger areas, in far less time. Using a high frequency side-scan sonar device along with a powerful hydrographic survey package like HYPACK® Marine Search, police and firefighters can cover an area of 8,000 square meters in as quick as 5 minutes. That's larger than a football field!



How's it work? Well, the software displays information from navigational charts and helps guide the vessel, all while coordinating data from a GPS and sonar system to provide an image of the river, lake or ocean bed. Compared to manual diver searches – agencies using this tag team of hardware and software exponentially increase the success of missions, all while keeping their dive personnel out of harm's way.

The Middletown, Connecticut Police and Fire Departments were one of the first to receive a HYPACK® Marine Search software package to support their search and recovery activities.

Thus far, their departments have used the survey package to search the bottom of the Connecticut River in Hartford with the help of Jerry Knisley, a

HYPACK team member. Together they were able to identify several vehicles along the west bank of the River involved in an open criminal investigation. During the search, the police department found another suspicious object that warranted further investigation. All in all, an eventful trip!

Xylem is truly honored to help the community, police, and fire departments improve their marine operations.

HYPACK hopes to continue helping local police and fire agencies all over the world to better their search and recovery operations. For more information on HYPACK® Marine Search, please visit: hypack.com

Xylem Welcomes Hypack to our Analytics Family

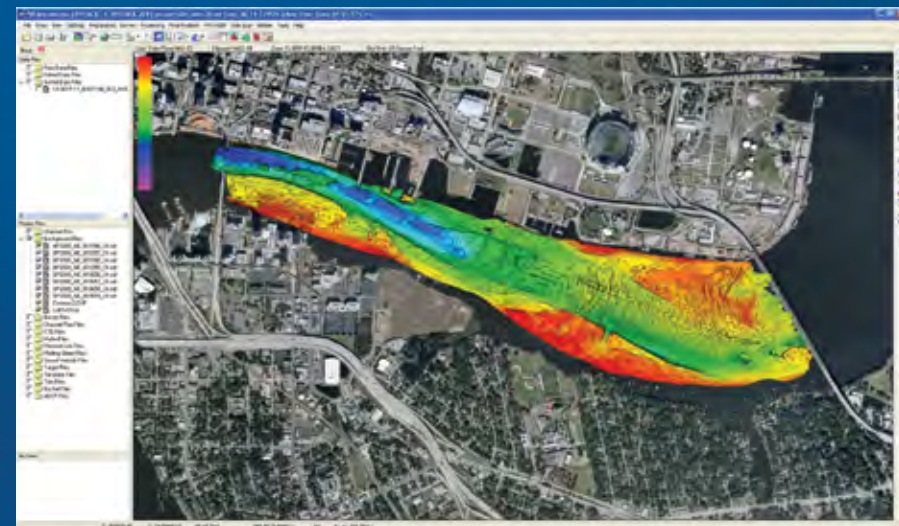
About

Located in Middletown, Connecticut, HYPACK is a leading provider of hydrographic survey data acquisition, processing, and visualization software. Used by government agencies, universities, and consultants, HYPACK products measure and map features in bodies of water in connection with maritime navigation, marine construction, dredging, offshore oil exploration, pipeline surveys, habitat assessments and search & recovery efforts.

With more than 25 years of experience, HYPACK is one of the most successful and leading providers of hydrographic and dredging software worldwide!

hypack.com

Our Software

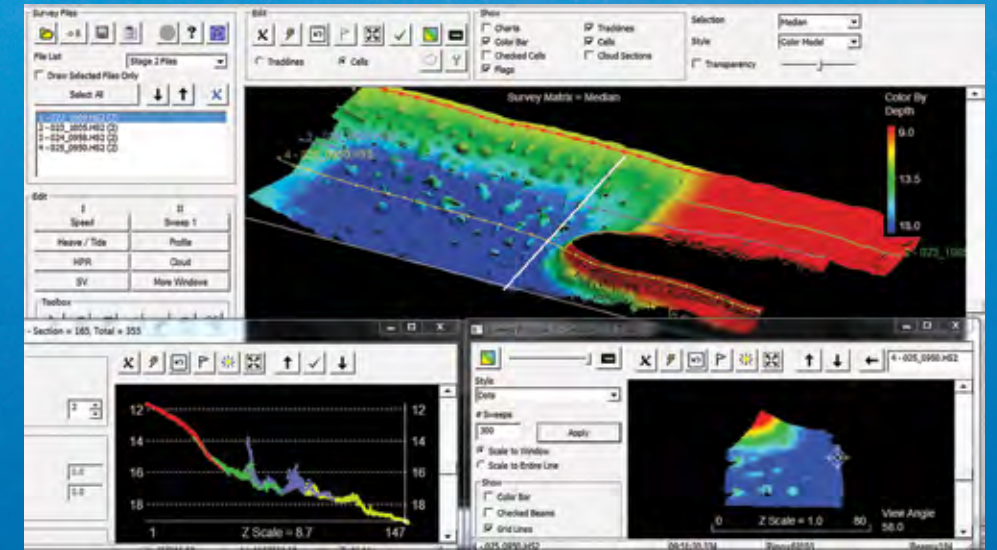


HYPACK® Software

With more than 10,000 users, HYPACK® Software is one of the most widely used hydrographic surveying packages in the world. Whether you are collecting single beam, side scan, magnetometer data, or just positioning your vessel in an engineering project, HYPACK® provides the tools needed to complete your job.

HYSWEEP® Software

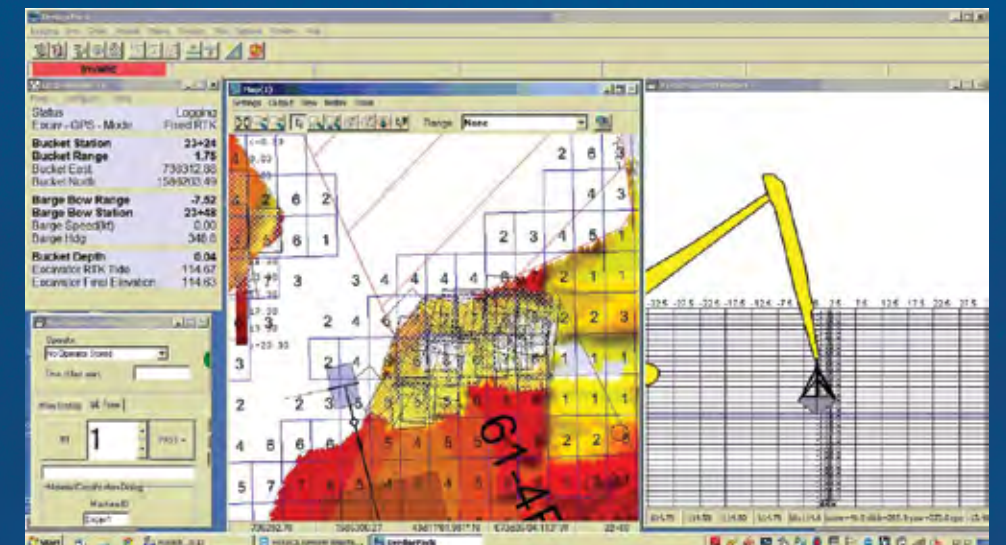
HYSWEEP® is our Multibeam, Backscatter, and Topographic Laser Software. It is a powerful module for multibeam and topographic laser calibration, data collection, and 64 bit processing. HYSWEEP® gives you the tools needed to complete your task in a system your surveyors can master.



HYPACK
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DREDGEPACK® Software

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Wetlands in the High Desert

The impacts of wetland habitat loss and the recovery effort in the high desert of the American Southwest.

◆ CORRIE PARRISH
UD River Stewards

Habitat Loss

Located in the heart of the middle Rio Grande region, Albuquerque lost 85% of its wetland habitats due to the growth of a city that is now home to over 70% of the population in New Mexico. With the increasing amount of impervious surfaces and the loss of natural infiltration of water into the ground, stormwater is causing detrimental effects that can be observed in the Mountain View neighborhood of Albuquerque, a part of town in the South Valley. It is classified by the Environmental Protection Agency (EPA) as an environmental justice area due to contamination from factories and an adjacent Superfund site.

The loss of wetland habitat in this area has wreaked havoc on species that rely on these areas to spawn. Several species of fish that used to thrive in the Rio Grande are at risk of going extinct. One such species is the Rio Grande Silvery Minnow, a small herbivorous fish that used to be found as far north as Española, New Mexico down to the Gulf of Mexico. Due to habitat loss in the Rio Grande from various forms of development, the Rio Grande Silvery Minnow can only be found in the middle Rio Grande region today. Should these minnows go extinct, it could disrupt the entire ecosystem along the Rio Grande because they are a major food source for larger fish, who are also struggling to survive in a river that often runs dry due to the amount of water allocated for various development efforts.

Valle de Oro National Wildlife Refuge

However, the establishment of Valle de Oro National Wildlife Refuge (NWR) is proving to be a major win for conservation for the Rio Grande and its wetland habitats. Established in 2012, Valle de Oro NWR is the first urban national wildlife refuge in the Southwest. While its main mission is conservation, Valle de Oro NWR also is a major advocate for environmental education, encouraging environmental stewardship and creating better access to open spaces for underserved populations, like the Mountain View neighborhood. Valle de Oro NWR stands for “Valley of Gold” an epithet given to honor the legacy of the land which previously was a dairy farm. In the fall, the fields and the Cottonwood forest lining the property turn several shades of gold as though it was nature’s way of saying this land is truly valuable.



Native American petroglyph featuring a bird, Petroglyph National Monument, Albuquerque NM
Photo: Joseph Sohm

The Endangered Southern Willow Flycatcher
Photo: D&D Photo Sudbury



The view looking East from the West bluff of the Rio Grande River at the Sandia mountains, Albuquerque, New Mexico.
Photo: Dave Stubblefield



Community Restoration
Photo: Mary Blake



Sandhill Cranes
Photo: Jose Armas



A New Generation
Photo: Genevieve Barret

Restoring the Balance

Although Valle de Oro NWR is still in its early stages of development, there will be five seasonal wetlands on the property. The wetlands will have sections of shallow and deep areas to accommodate a wide diversity of plant and animal wetland species. While the wetlands discourage larger birds that are often found on the Refuge, such as Sandhill Cranes and Canada Geese, the habitat that will be restored could bring back several lesser seen birds, such as the endangered Southwestern Willow Flycatcher.

In addition to the varying depths, the wetland habitat will also mimic the historical footprint and natural path of the previous saturated area. The wetlands in Valle de Oro NWR will curve in and crisscross diagonally across the property until it reaches the river. Both grey water sent to Valle de Oro NWR from the Water Waste Authority and seasonal storm water will pass through a grate to prevent any bigger pieces of debris or trash from entering the wetlands. From there the water will go through the series of wetlands to naturally be cleaned as it cycles through various wetland plants until it reaches the retention ponds built by the river; where it will then slowly dissipate back into the river as clean water. In conjunction with other partners involved in the development of the Refuge, seventy-three acres of water are pledged to go back into the river for wildlife use. This will ensure that the Rio Grande Silvery Minnow (and other fish) have enough habitat in which to survive.

Young Stewards

Students visiting the Refuge have already begun to learn how to conduct water quality tests on the Refuge. The students will learn how the water impacts the plants and animals that depend on the wetland habitat for survival and how they can protect such habitat from being further destroyed in the area. Trails are planned to be built leading to and around the Refuge to encourage alternative transportation modes, such as biking. The community will also have access to trails that will interlace through the wetlands for learning opportunities and wildlife viewing.

While development in the Mountain View Neighborhood has historically had negative consequences for the surrounding environment, due to the loss of surrounding wetland habitats, the development of Valle de Oro NWR and its wetlands are proving how valuable this part of the country is, especially when water is looked at as though it were gold.

For more information about the Refuge and how you can help, please visit: www.fws.gov/refuge/valle_de_oro/



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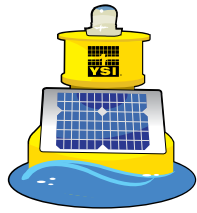
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YSI Integrated Systems & Services
St. Petersburg, Florida USA

Saving money by providing actionable data

Communities everywhere need access to suitable drinking water, and reservoirs throughout the U.S. help to serve that purpose. Managing the quality and availability of this basic yet essential resource is a challenge, and invariably, costs are always a factor.

YSI Integrated Systems & Services supplied a municipality in New York with a water monitoring solution. The solution consisted of seven Pontoon Vertical Profiling Systems (VPS) equipped with EXO2 sondes. With the water quality data provided by the automated systems at specific depths, the customer can minimize treatment and filtration costs by pulling water from the optimal intake depth.

The data collected from these systems provides information to reservoir operators and their management systems that help determine the daily usage based on capacities, models, and weather. These remote systems are interfaced to the local laboratory information management system to help insure 1 billion gallons per day of suitable drinking water reaches citizens.

As a result of the success this organization, plans are underway to expand their monitoring network to facilitate the delivery of clean water to an ever growing population.

For more on the Vertical Profiler:
[+1 \(727\) 565-2201](tel:+17275652201) | YSIsystems.com



Xylem Analytics UK
Letchworth, Hertfordshire UK

Profiling the entire water column helps to improve decisions on water abstraction.

Droughts can take a toll on the availability of water to the inhabitants of any city, but near London's Heathrow Airport, a vertical profiling system has been deployed on the Queen Mother Reservoir to help decision makers make prompt money saving decisions for their community.

Terry Bridgman, Field Scientist in the water quality team at Thames Water tells us, "We have always wanted a technology such as the Profiler because knowledge of water quality throughout the entire column helps to improve decisions on water abstraction. Water can be drawn from different depths and if we know the position of the best quality water we can minimize water treatment costs."

Reservoirs form an important step in the water supply chain because, through sedimentation and natural enhancement of biological quality, they represent a low-cost method of water quality improvement.

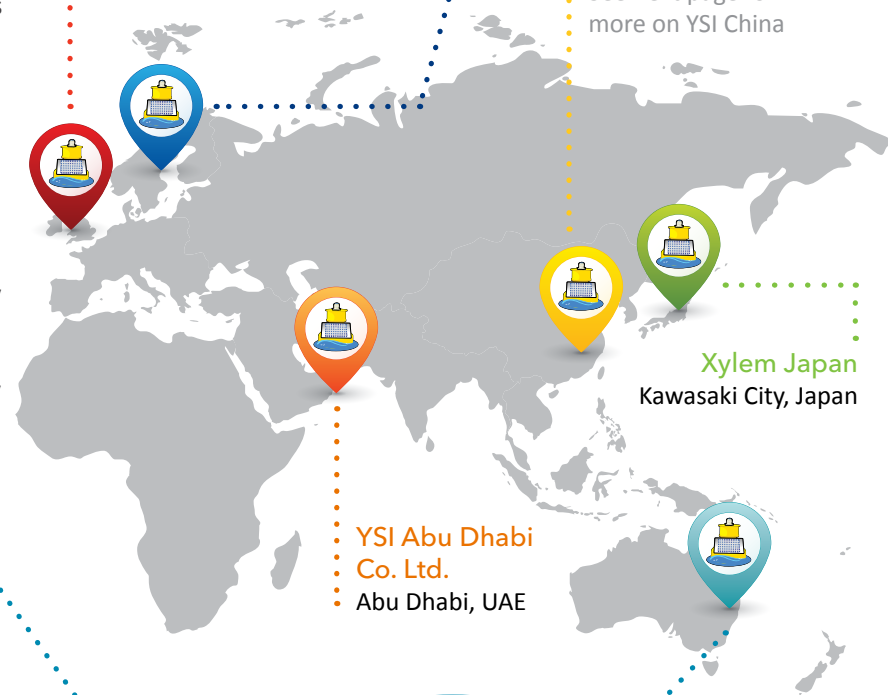
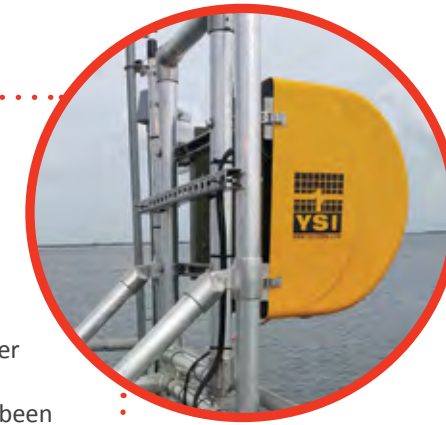
Xylem Analytics Australia Pty. Ltd.
Hemmant, QLD Australia

Getting creative with the Vertical Profiler

A significant portion of the Australian water supply from reservoirs suffers from manganese issues.

Griffith University School of Engineering (Gold Coast, Australia) and Scientific Services and Data Systems (Seqwater in Brisbane, Australia), working with data acquired from an automated water quality monitoring station have developed a model that gives 7 days-notice for predicted Manganese (Mn) levels in reservoirs. Even though the system does not measure Mn itself, Edoardo Bertone (Ph.D. student), developed a model that measures the variables that affect Mn concentration.

This model allows the treatment staff to proactively prepare in advance of predicted manganese spikes. Early warning allows operators to use the appropriate dosing methodology, and can save the governing body, or Council, up to \$120,000 on labor that was previously required for grab sampling.



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See next page for more on YSI China

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China: Dawning Insight

With its massive economy, massive population and massive water management networks, China has huge needs for water quality data.



China's diverse ecosystems, public water reserves and engineering projects offer a wide variety of monitoring opportunities.



Bedeviled by devastating pollution and some of the worst floods in human history (including a 1931 deluge that reportedly killed 3.7 million people and a 2007 flood that ruined crops on nearly 30 million acres of farmland), China's infrastructure agencies and Ministry of Environmental Protection face epic challenges daily.

A historic lack of data has hampered their efforts. But when China's president and chairman of the Communist Party Hu Jintao called for greater scientific development on water quality issues — including drinking water safety, pollution prevention and water conservation — in 2007, China's water quality measurement efforts shifted into high gear.

Today, government officials and nongovernment organizations (NGOs) are building the nation's body of knowledge on China's water supplies.

James Chen, Vertical Market Manager at Xylem Analytics China, works with fellow employees in setting up a reservoir buoy.

Olympic Hopeful

WHY RIO'S WATER ISN'T MAKING THE CUT

◆ LUKE GIROUX

Every four years, since the late 19th century, athletes gather together from around the globe to compete in the largest sporting event in contemporary times, the Olympic Games. This summer over 10,000 athletes, culminating years of preparation and dogged determination, will go for the gold in Rio de Janeiro.

Of the 10,000 athletes competing in the 2016 summer games, about 1,400 are engaged in outdoor water sports. Whether it's rowing, sailing, canoeing, triathlon, or distance swimming, five out of the 42 summer Olympic sports will take place in bodies of water in and around Rio.

When most of us think about Rio, we picture a tropical oasis of beaches, water, surf, and sun. Visions of Copacabana beach along the Atlantic Ocean, with suntanned natives and an active night life, are typical visuals that come to mind. These images are much different than the stark reality that awaits the Olympians as they travel to Brazil this summer. Household waste and raw sewage, and the infestation of the bacteria that accompany them, have been the norm in the waters in the shadow of Christ-the-Redeemer statue.

RIO DE JANEIRO, BRAZIL -
Skyline view of Sugarloaf Mountain
and Guanabara Bay at sunrise.
Photo: lazymlama



Fragile residential constructions of Favela Vidigal in Rio de Janeiro.
Photo: Donatas Dabravolskas



Biggest Slum in South America, Favela Rocinha, Rio de Janeiro
Photo: Dmitry Islentev



Many of Rio's poorest residents live in broken-down slums, tarpaper shacks built on top of each other, pressing up to the banks of sewage-blackened rivers. Clumps of waste float listlessly by, the surface bubbles with escaping gases, penetrating the air with a sulfuric stench as it makes its way into nearby Guanabara Bay. Not exactly a tropical oasis, nor an ideal setting for world-class athletes.

Brazil is the world's seventh-largest economy, but struggles on the world stage when it comes to access to water and sanitation. A fiscal crisis that shook Brazil in the 1980s largely froze sewer investment in Rio for two decades, and it took another decade for regulations divvying up responsibility for those investments between the municipal, state, and federal governments.

During that time Rio's population experienced explosive growth – from around 9 million in 1980 to 12 million today, and the situation was compounded by poor city planning, political infighting and economic instability.

Challenges of Olympic proportions

When the City of Rio pitched their Olympic plans for hosting the 2016 summer games to the International Olympic Committee (IOC), their intent was to have the sailing competitions take place in Guanabara Bay, rowing and canoeing in Rodrigo de Freitas – the picturesque tidal lagoon in the heart of the city – and the triathlon and swimming events off of Copacabana Beach in the Atlantic Ocean.

The city's plans, presented to the IOC a decade ago, also acknowledged the water quality challenges that Rio faced. And a significant part of the bid package promised to make improvements to water infrastructure and to address water quality concerns in the waters used for the competitions. The plans called for, among other improvements, an 80% reduction in sewage and waste in Guanabara Bay.

Fast forward 10 years and challenges still exist, with the pending Olympic activities rapidly approaching. Images of massive amounts of dead fish and household waste floating in Rodrigo de Freitas and other Rio waterways are all over the internet, as are numerous reports of athletes getting sick after training in Olympic venues. Although there has been much speculation yet no direct correlation of the illnesses to the polluted water, the world community is asking questions about the improvements that have been made, to ensure the health and wellbeing of the 10,000 athletes – and the millions of spectators – that will descend upon Rio in the coming months.

City and IOC authorities insist they are addressing water quality issues at Olympic venues and beyond. Ongoing monitoring and assessment of competition locations have taken place since the bid was awarded to Rio in 2009, and certainly some progress has been made. The state sewage company has built eight new sewage pumping platforms in the lagoon, eliminated illicit sewage dumping pipes that fed into it, and created a control center to monitor potential dumping.

Sewage treatment stations have also increased their utilization rates and advanced from primary treatment, mechanical methods that separate waste from water, to secondary treatment, which uses biological processes to further remove organic matter. A fleet of two dozen eco-boats have been methodically patrolling Rio waterways, scooping up floating debris in their path, and will continue to do so even after the games have come and gone.

The Brazilian government has spent more than \$1 billion in clean-up efforts, significantly less than expected, the economic challenges of the recession curtailing additional plans. Because of their efforts, however, the percentage of sewage that still goes untreated in the metropolitan area has dropped significantly since 2009 – from 83% to 50% – and is expected to drop even further, to roughly 20% by the time the Olympic torch is lit in August.

Global presence, global impact

To their credit, the IOC has a history of choosing cities and countries to help effect change within those regions. The 2008 summer games were granted to Beijing, in the hopes of opening China to the rest of the world. In 1988, the summer games went to Seoul, to help usher in a civilian government at a critical juncture in Korea's history. The intention of the IOC in choosing Rio, was to help expedite the advancement of Brazil as a developing country.

If the IOC continues to choose global communities to help effect change, which is certainly a noble objective and a primary benefit of the games, then we'll continue to see issues like those we've seen in Rio. These issues exemplify the challenges of an expanding society, struggling to maintain the regulated constraints of growth, juxtaposed against the fundamental infrastructure necessary to keep that society safe from disease and environmental catastrophe.

Water quality and sanitation issues will continue to plague the city of Rio, long after the Olympic flame burns out. But if the coastal oasis continues to implement the sanitary and water treatment improvements that were promised, they will keep the Olympic spirit of Rio alive, and their residents, visitors and local environment safe and healthy well into the 21st century.



ZIKA!

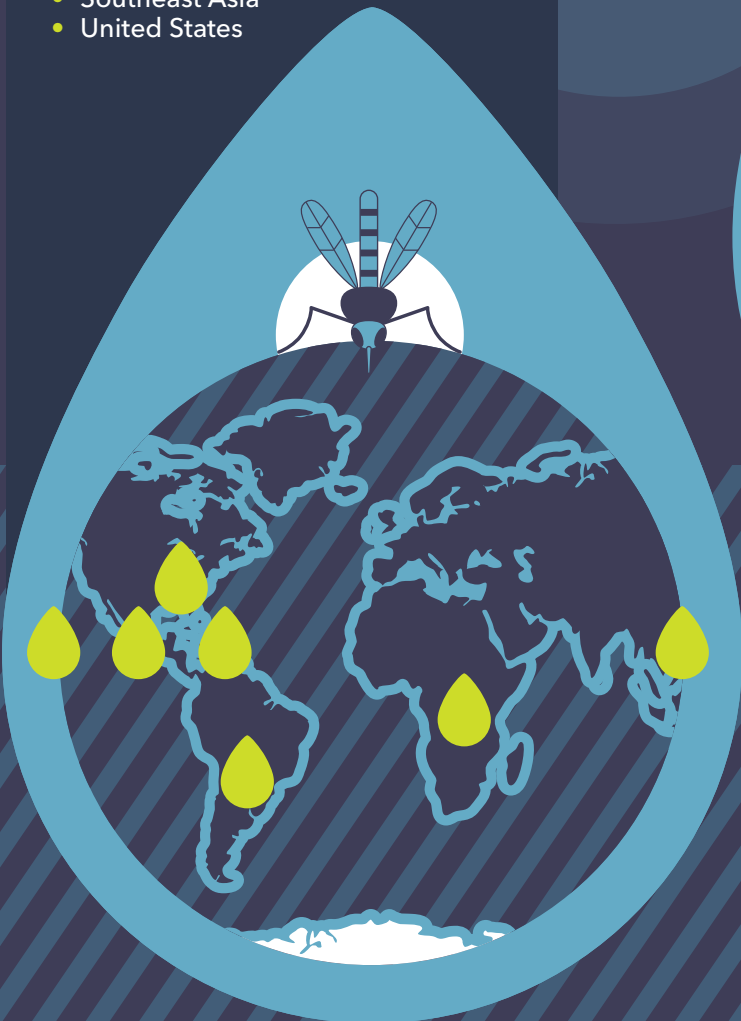
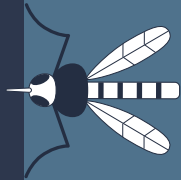
What is the Zika Virus?
 The Zika Virus is a disease related to dengue, yellow fever, and the West Nile Virus. It is spread by the bite of an infected **Aedes mosquito** or via sexual transmission.

The Zika Virus, Mosquitoes and Water: An Unhealthy Relationship

The **Aedes mosquito** is in every continent except Antarctica.

The **Zika** virus has been found in:

- Africa
- Caribbean
- Central America
- Mexico
- Pacific Islands
- South America
- Southeast Asia
- United States



Common Symptoms of the Zika Virus

Symptoms are usually mild and begin 3-7 days after being bitten.

- Fever
- Joint pain
- Muscle pain
- Rash
- Red eyes
- Birth defects



Why Should We be Worried?

Zika is linked to microcephaly, the development of unusually small heads and brain damage in newborns.

Zika is linked to Guillain-Barré syndrome, an autoimmune disease caused by the body's immune system mistakenly attacking the nervous system.

Few in the Western Hemisphere have an immune defense against the virus.

The World Health Organization (WHO) has declared **Zika** an international public health emergency.

30 countries have been identified as travel threats to pregnant women.



Water—Where the Problem Begins.

Mosquitoes breed in standing (stagnant) water found in:

- Containers (flowerpots, cans, tires)
- Freshwater lakes and ponds
- Freshwater swamps and marshes
- Flooded areas
- Stormwater and wastewater retention areas

Water—Where the Solution Starts.

Mosquito abatement starts by keeping water clean.

- Empty, drain, or cover anything that can hold water
- Eliminate standing water in pots, buckets, barrels, tires, yards, pools
- Ensure proper drainage around homes and businesses
- Clean bird baths regularly
- Repair outside leaks
- Chlorinate swimming pools
- Unclog rain gutters and drains
- Aerate the water in your fountains, ponds and lakes.



CORAL BLEACHING

In 2005, the U.S. lost half of its coral reefs to a massive bleaching event. Scientists are determined to keep it from happening again.

◆ STEVE WERBLOW

Bustling, vibrant coral reefs have faded into pale underwater ghost towns, threatening biodiversity around the world. Over the past 30 years, massive bleaching events in the Galapagos Islands, the Coral Triangle of the western Pacific, and the Caribbean have alarmed scientists, who worry about the ability of reef ecosystems to recover from bleaching, especially in the face of increasingly warm El Niño weather cycles.

Warm sea surface temperatures cause corals in the western Pacific to begin to bleach. Bleaching occurs when symbiotic algae, known as zooxanthellae, are expelled from coral tissue.
Photo: Acro Phuket

Coral reefs are massive colonies of tiny organisms living in a delicate balance. Coral polyps are related to sea anemones and jellyfish, with tentacles that wave in the water to capture and draw in food. The polyps protect their soft bodies by building cup-like exoskeletons around themselves. Billions of those skeletons form the stony reefs that shelter not only the polyps, but also thousands of species of fish, crustaceans and other sea life—in fact, as many as 25 percent of marine species rely on coral reefs for food or habitat.

Among the tiniest of those reef residents is a linchpin in the ecosystem. Inside their fortress-like exoskeletons, corals host zooxanthellae, microscopic algae that use carbon dioxide and nutrients from waste products excreted by respiring coral to fuel their photosynthesis. Through that process, the algae produce sugars, fats and oxygen that help sustain the coral.

But if water temperatures climb too high, the algae exude toxic products, causing the coral to expel the zooxanthellae and turn ghostly white. Deprived of nutrition that had been provided by the algae, the coral can die in weeks. Certain types of coral die off more quickly than others, causing shifts in the ecological balance of species.

At the Smithsonian Tropical Research Institute (STRI) in Bocas del Toro, Panama, postdoctoral fellow Dr. Janina Seemann has studied coral bleaching in the Caribbean and is at the forefront of researching the ecological effects of human activities on coral reefs. Her work is part of the MarineGEO (Marine Global Earth Observatory), the Smithsonian’s detailed, long-term survey of coastal water conditions and life forms around the world, coordinated by Dr. Emmett Duffy.

Data is Critical

Water quality data is at the heart of the MarineGEO research Seemann is conducting. She relies on a pair of EXO sondes from YSI, a Xylem brand, to track a wide range of water quality parameters. One EXO sonde gathers a continuous stream of data from a platform in Panama’s Almirante Bay, providing a running overview of seasonal changes in water temperature, salinity, turbidity, pH, blooms of plankton or algae, and other variables.

Seemann and her colleagues bring the other EXO sonde to a variety of study locations every two weeks to measure depth, dissolved oxygen, pH, chlorophyll and turbidity, shedding light on water quality parameters that can impact the health of coral and algae. Instrument sensitivity is important, she notes: for instance, even slight changes in water pH can affect calcification by the polyps.

Nutrient (using chlorophyll as an indicator), sediment (measured as turbidity) and heavy metal levels in the bay are heavily influenced by human activity. Seemann’s focus is studying the effects of those human influences on the local reef community.



Reef Monitoring with an EXO2 Sonde
Photo: Dr. Janina Seemann

“ The water temperature gave us the reason why the coral was bleaching. ”

Indicator Parameters

Correlating water quality data with observations of the environment helps Seemann explain changes in the reef.

“We plotted data for water temperature from last year to this year,” she said in late 2015. “We detected a tremendous increase in water temperature in September. Correlated to this, there was a definite coral bleaching episode. The water temperature gave us the reason why the coral was bleaching.”

Seemann points out that STRI’s portable EXO sonde allows her to compare water quality in different environments—for instance, taking measurements in connected mangrove fringes, seagrass beds and coral reefs—on the same day, measuring the water-cleansing effects of mangrove roots or seagrass for coral reefs. Water quality measurements also allow her to understand the value of adjacent terrestrial systems, such as primary forests, in protecting reefs from pollution—particularly sediment runoff.

That’s a key goal for Seemann. Deforestation and the cultivation of banana farms have led to an intensive amount of nutrients, sediments and pesticides traveling down the Changuinola River to enter Almirante Bay. Nutrient plumes in the water column can spur plankton blooms. That cloudy, enriched water may provide more food for coral polyps, but simultaneously deprive zooxanthellae of the light they need to photosynthesize. The enriched, or eutrophic, conditions can also support other organisms such as sponges and algae, which overgrow the corals. It’s a set of trade-offs that must be understood to predict the effects of human activity on the reef.



Dr. Seeman of MarineGEO
Photo: Dr. Janina Seemann



Water Sampling with an EXO2 Sonde
Photo: Dr. Janina Seemann

Spreading the Word

Seemann is one of the first scientists engaged in the Smithsonian's Marine Global Earth Observatory (MarineGEO) program. The global effort was launched in 2013; STRI joined the program in 2015 under the leadership of Dr. Andrew Altieri. Data from YSI sondes and other instruments at study sites around the world is channeled through the Smithsonian's web servers to provide near-real-time data to scientists and other interested people across the globe.

Streaming data from the field and making it accessible to a wide range of users—from readers of peer-reviewed journals to visitors to the MarineGEO Facebook site—MarineGEO data is attracting a global audience.

“ We want to bring it to the public...in a way that everyone can understand. ”

“It starts with a normal person who's interested in what's going on in the environment to an environmental NGO [non-governmental organization] to a government policymaker,” Seemann says. “We want to bring [the data] to the public in all kinds of ways, to present it in a way that everyone can understand it and the network can grow.”

At YSI, product manager Brandon Smith says Seemann's work with MarineGEO reflects the power of good data. “Water quality data from anywhere in the world can be shared almost instantly, integrated into analytical software, and become part of a stream of information that teaches us about our environment around the world,” Smith notes. “It's an immensely powerful tool that can help scientists, policymakers, local stakeholders—and, ultimately, all of us—make better decisions that influence the health of the planet.”

Seemann says coral reefs demand attention and care. “If you lose corals, you lose biodiversity of other organisms—fish, crustaceans, echinoderms,” she emphasizes. “Other organisms live in exchange with the reef.”

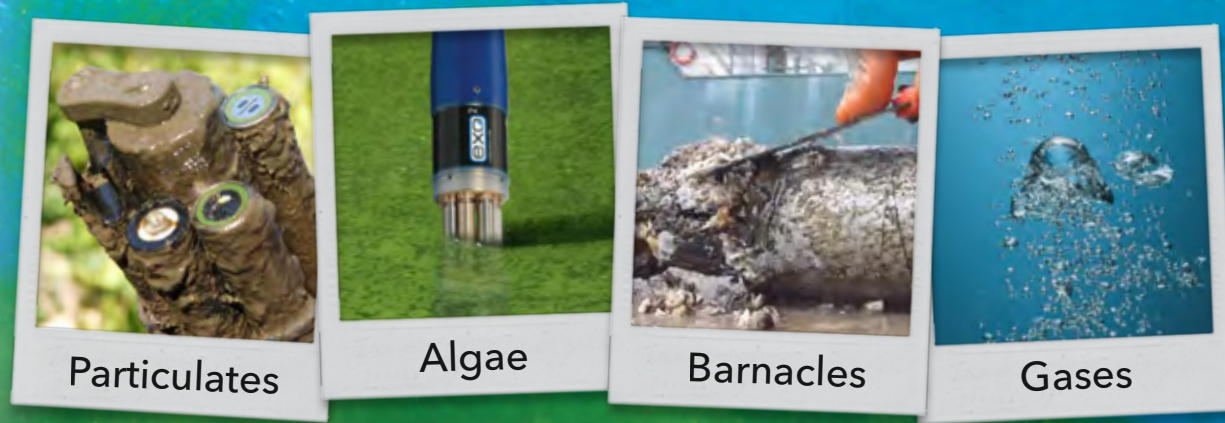
Including us. 

Coral Bleaching in the Caribbean
Photo: Dr. Janina Seemann



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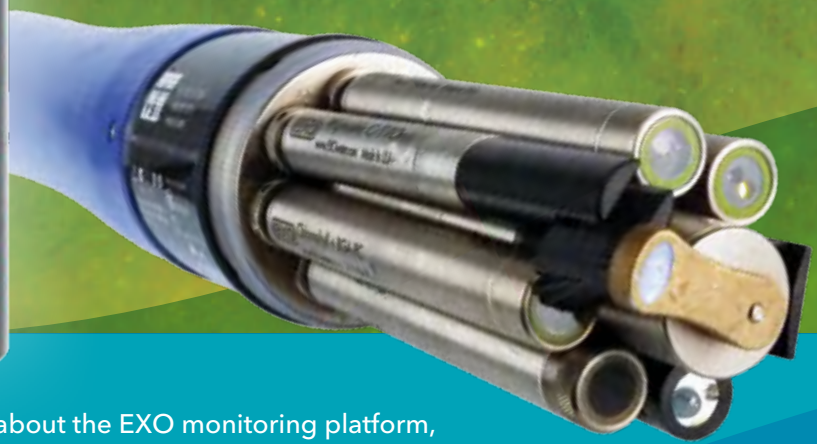
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“ My dream for the ocean is that we are able to take care of it, stop acidification and to not pollute the ocean as we do today. ”

Jostein Hovdenes, Product Development Manager for Aandera

XPRIZE®

Oceans have been experiencing a decrease in pH due to increasing amounts of carbon dioxide (CO₂) in the atmosphere.

Reliable and practical technology for accurate long term monitoring of pH in the ocean has been lacking for many years. In the light of escalating ocean acidification, it is of high importance that this technology gap is filled. The Wendy Schmidt Ocean Health XPrize competition challenged teams of engineers, scientists and innovators to create pH sensor technology that will affordably, accurately and efficiently measure ocean chemistry. The \$2 million prize competition hoped to turn the tide of ocean acidification.

Xylem entered the competition as a joint project with members from Aanderaa and YSI in a collaboration across borders. The team brought

together innovative engineers with experience commercializing sensors and scientists from leading research institutes comprised of individuals from two Xylem businesses; Aanderaa Data Instruments in Bergen, Norway and YSI in Yellow Springs, Ohio.

“If the health of the world’s oceans were to deteriorate significantly, this would have a massive impact on the fisheries and aquaculture industries all over the world and of course would be a catastrophe for the world’s population.” - Peter Thomas

In addition, scientists from research institutes in Norway and Sweden participated. The team goal was to develop a pH sensing solution that not only offers the required performance criteria under the full range of environmental conditions but is also easily manufacturable, reliable, intuitive

to use, and cost effective. In a relatively short amount of time, they were able to design and test a new optical sensor utilizing optics behind a rugged sapphire window in a titanium package capable of deep ocean measurements at low power. The competition gathered scientists from around the world for extensive laboratory and ocean testing, in depths up to several thousand meters. After months of trials, Xylem's design qualified for the elite final round as one out of only 5 teams. Even if the sensor did not win first prize, it demonstrated how collaborations can yield world class solutions for monitoring the environment in new and innovative ways.

Whether it is for wildlife in the oceans, for global fisheries, or key species in the food chain, monitoring pH will provide critical information to help gain a better understanding of this phenomenon and how we might be able to combat it.



Wendy Schmidt Ocean Health XPRIZE
Video: <https://youtu.be/VM5C5JloI0g>

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On a New Kind of Hunt

Inuit Hunters use CastAway CTD's to gather data beneath Hudson Bay ice.

◆ STEVE WERBLOW & JOEL HEATH

The hunters recognized the changes.

A shot seal would usually float, buoyed by its blubber atop the dense salt water of Canada's Hudson Bay. Now the seals were sinking below the surface before the hunters could reach them. Polynyas, the open patches of sea surrounded by ice, were freezing over with brittle, clear ice, often with little warning. Beluga whales were being trapped beneath the floes, cut off from their surfacing holes. Arctic eiders, the diving ducks whose down is a source of warmth and commerce for the Inuit, were trapped on the ice, dying like flies.

Joel Heath began traveling to the isolated Belcher Islands of eastern Hudson Bay in 2002, when he arrived to begin his Ph.D. research on how animals survive on winter ice. Eiders, which stay in the area all winter long and serve as an indicator species for the health of the ecosystem, quickly captured his attention. So did the people who have been linked for generations to the eiders.

"I became interested in the cultural story," says Heath. "That got me interested in doing the documentary *People of a Feather*. I went from the more pure academic interest to concern for the communities."

What Heath saw concerned him deeply. Hudson Bay water is typically about as saline as seawater, with 30 parts per thousand (ppt) salinity. However, a massive plume of fresh water was flowing beneath the ice, lowering the salinity of the upper 25 meters of Bay water to 25 to 26 ppt. The hunters of Sanikiluaq and their neighbors in the small communities ringing the southeastern Hudson Bay had front row seats to a massive ecological disturbance—quite literally, a sea change.

In a dazzling example of citizen science, Inuit hunters from five Hudson Bay communities are gathering data on a massive plume of fresh water that is changing their environment.



On the lookout for Polar Bears



Arctic Eider Duck



Arctic Fox



Collecting interior Street View imagery of an igloo in Sanikiluaq

Reversed Cycle

Heath's first winter on the ice in 2002 coincided with a landmark agreement between the Cree people of Quebec, the federal government and the government of Quebec that permitted the completion of the second phase of the James Bay Project. The massive hydroelectric venture, begun in the 1970s, was already one of the largest hydropower systems in the world. By the end of construction on Phase II, it would include eight hydroelectric generating plants and divert many of the rivers in eastern Canada to drain through the mouths of the Rupert River and the La Grande—just off the Belcher Islands.

What's more, the dam releases that drive the hydroelectric turbines don't follow the ebb and flow of the region's normal hydrological cycle.

"Electrical demand is highest in the winter," Heath explains. "Usually we'd have flooding, our highest flows, in the spring. The hydrological cycle has been reversed. Rivers have been re-routed, and it all comes over to southeast Hudson Bay."

Fresh water freezes at a higher temperature than saltwater does. The ice it forms is clear and brittle, which means freshwater floes behave differently than

sea ice, interfering with normal flow patterns. And fresh water freezes more quickly than sea ice does, which is why whales can find themselves caught in the ice, as they did in 2013 when more than 70 belugas were trapped under a shrinking hole and mauled by polar bears.

In 2011, Heath released *People of a Feather* to raise awareness of the challenges faced by the residents of the Belcher Islands. That year, he also established the Arctic Eider Society as a foundation for fundraising and a focal point to study the science and community impact of the changing water. Working with the local communities, Environment Canada, University of Manitoba and other stakeholders, he set the course for a sweeping study of water and ice across the region.

CastAways: Citizen Science

Heath began by enlisting members of the community of Sanikiluaq to help take samples of ice and water. In 2014, he outfitted five small communities with CastAway-CTDs from SonTek, a Xylem brand, and trained a cadre of hunters how to use them and upload their data. CastAway-CTDs are softball-sized instruments that measure conductivity—which in turn indicates water's salinity—as well as temperature and depth.

The CastAway-CTD is extremely easy to use—everything a user needs to know about collecting data, viewing the readings, and downloading files from its onboard memory, fits on a single sheet of paper. Users turn the units on, lower them into the water on a line, and steadily bring them back up. The instrument takes readings every few seconds, automatically logging data on the water column.

"Training is pretty easy," Heath says. "People are pretty competent with that kind of stuff, and it's a pretty straightforward interface. We spend a day with the hunters on the ice, going to different spots and trying them out. By the end of the day, they've got it."

Today, about two dozen hunters from the Inuit communities of Sanikiluaq, Kuujjuarapik, Umiujaq and Inukjuak and the Cree village of Chisasibi prowl the ice not just with rifles, but with CastAways and sample jars. In the winter of 2014-2015, the hunters and several students working with the Arctic Eider Society conducted more than 100 measurements. Heath's goal for 2015-2016 is to top that.

SonTek Donation

SonTek donated two of the CastAways to the Arctic Eider Society to aid in the group's work. SonTek product manager Isaac Jones says Heath and his team of citizen scientists provide an inspiring example of how stakeholders can harness the power of data.

"Joel's work with the communities of the southeast Hudson Bay demonstrates the power of local people to tap into today's mobile technology and bring us all out onto the ice to understand

the phenomena they're seeing in their environment," says Jones. "We're proud that the Arctic Eider Society selected CastAway-CTDs for its important mission, and glad to be able to contribute to its efforts. The work of the hunters with our CastAways doesn't just represent some of the most extreme deployments of the technology—it reminds us how science and tradition unite to help us understand even the most challenging ecosystems."

Throughout the winter, hunters pick up their community CastAways as they head out onto the ice.

"We've tried to set it up so we have hunters in each community going out in different directions on the ice once a week," Heath says. "We have up to two trips per week [from each community]. We pay the hunters to be going out. They can do their subsistence hunting, too. Young people are also going out with them to learn about traditional knowledge and subsistence."

Inuit hunters check data on a SonTek CastAway-CTD on the ice in Hudson Bay.



Who's Minding the Planet?



The product of space-age instruments and age-old hunting routes is accessible online at arcticeider.com

Science and Tradition

The traditional knowledge of local hunters is an integral part of the Arctic Eider Society's approach to science. Heath and students from the University of Manitoba avidly study how hunters read the ice for information on weather and conditions, and how they track wildlife through the winter.

They also ask hunters to interpret time-lapse footage Heath shoots on the ice, looking for insight into changes in the freezing and break-up cycles of the floes. Aerial photography provides landscape-scale perspective on the ice and wildlife populations. Video shot on the ice, and below it, yield insight into feeding patterns and energy requirements for the eiders and other wildlife wintering in the harsh—and changing—environment.

Measuring currents with acoustic Doppler profilers allows Heath and his team to chart water flow patterns. Detailed water quality monitoring measurements provide a more thorough look into the sources of the fresh water in the Bay, including dissolved oxygen, dissolved organic matter and other parameters.

Heath says analyzing the oxygen isotope O_{18} in water and ice samples indicates that the fresh water is not the product of melting ice, but rather of inland water. He hopes analysis of other isotopes will someday allow scientists to track individual water samples back to their original river sources.


The product of space-age instruments and age-old hunting routes is accessible to researchers, policymakers and science buffs online. Each of the hunters on the data gathering team has a Facebook-style profile on arcticeider.com.

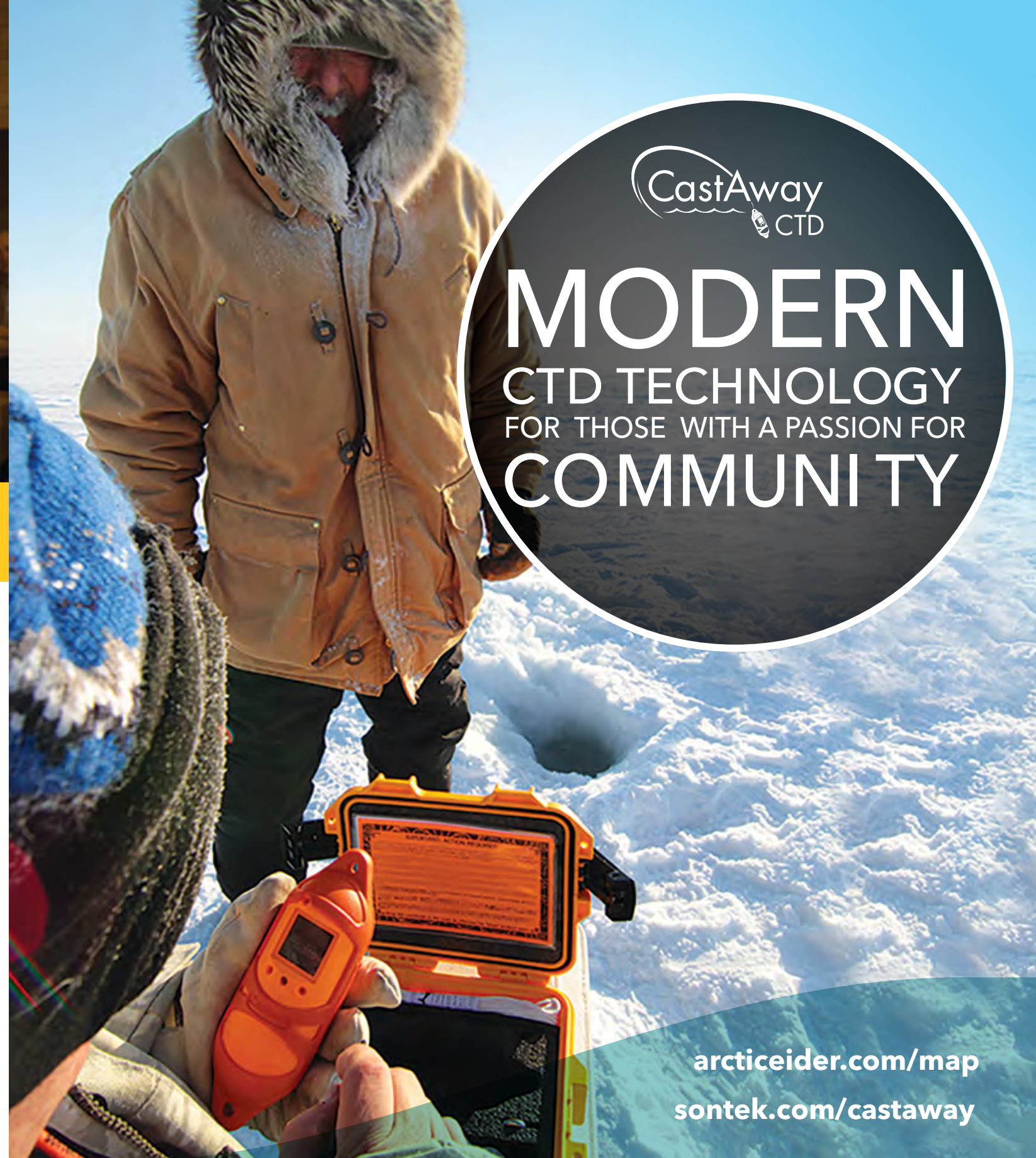
Visitors to the site can click on sampling locations for a look at each hunter's data or share pictures or charts on social media. Teachers can tap into the Arctic Eider Society's educational curriculum and stream time-lapse footage from the ice into their classrooms. And visitors can take a street-view virtual tour of the ice using Google Maps, which conducted the first-ever mapping of remote sea ice in the community of Sanikiluaq in the winter of 2014-2015.

Starting Here

Beyond the top-notch website and award winning documentary film, Joel Heath and the Arctic Eider Society are working to bring together regulators and stakeholders to focus on solutions for one of Canada's most overlooked regions—a way to balance society's need for power and the effort to repair a severely damaged ecosystem.

Heath is campaigning for a new approach to energy management that could store and distribute James Bay Project power in step with the hydrologic cycle. It's a massive vision, and it will require deep understanding of a complicated ecosystem.

With the help of dedicated hunters and five palm-sized CastAways, Heath is working to literally turn the tide. 



CastAway
CTD

MODERN
CTD TECHNOLOGY
FOR THOSE WITH A PASSION FOR
COMMUNITY

arcticeider.com/map
sontek.com/castaway

The CastAway-CTD is featured as part of a community driven research program to better understand ice ecosystems, wildlife profiles, and sea ice features in the Hudson Bay area. A new, online mapping platform is spearheaded by the Arctic Eider Society and includes georeferenced site markers to log salinity, temperature and depth data for each location.



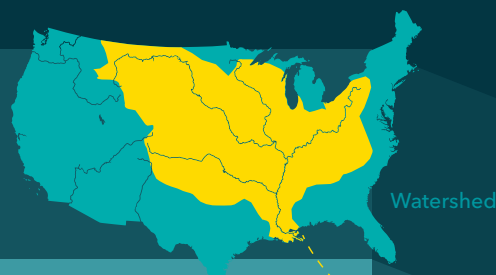
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Understanding HYP XIA

Hypoxia is an environmental phenomenon where the concentration of dissolved oxygen in the water column decreases to a level that can no longer support living aquatic organisms. The level is often considered to be **2 mg O₂ per liter** of water or lower.¹ Hypoxic and anoxic (no oxygen) waters have existed throughout geologic time, but their occurrence in shallow coastal and estuarine areas appears to be increasing as a result of human activities.²

What causes hypoxia?

In 2015, scientists determined the Gulf of Mexico dead zone to be **6,474 square miles**, which is an area about the size of Connecticut and Rhode Island combined.³ Major events leading to the formation of hypoxia in the Gulf of Mexico include:



1 Runoff and nutrient loading of the Mississippi River.

Nutrient-rich water from the Mississippi River forms a surface lens.

2 Nutrient-enhanced primary production, or eutrophication.

Phytoplankton growth is fueled by nutrients.

3 Decomposition of biomass by bacteria on the ocean floor.

Phytoplankton die and sink to the bottom.

Bacteria consume oxygen during decomposition in the bottom layer of water.

4 Stratification prevents the return of oxygen.

Organisms that are able, flee deadly low oxygen zones.

Mass anoxic areas form Dead Zones.

Organisms that cannot move away die off.



Coastal Hypoxia and Eutrophication

● Areas of anthropogenically-influenced estuarine and coastal hypoxia.

n > 550 In the past century, Hypoxia has become a global concern with over 550 coastal areas identified as experiencing this issue.⁴



Only a small fraction of the 550-plus hypoxia zones exhibited any signs of improvement.⁵



Number of dead zones has approximately doubled each decade since the 1960's.⁵



Combined, Dead Zones cover **4x** the area of the Great Lakes.

Today, there is currently about 1,148,000 km² of seabed covered by Oxygen Minimum Zones (OMZs) (<0.5 ml of O₂/liter)⁵



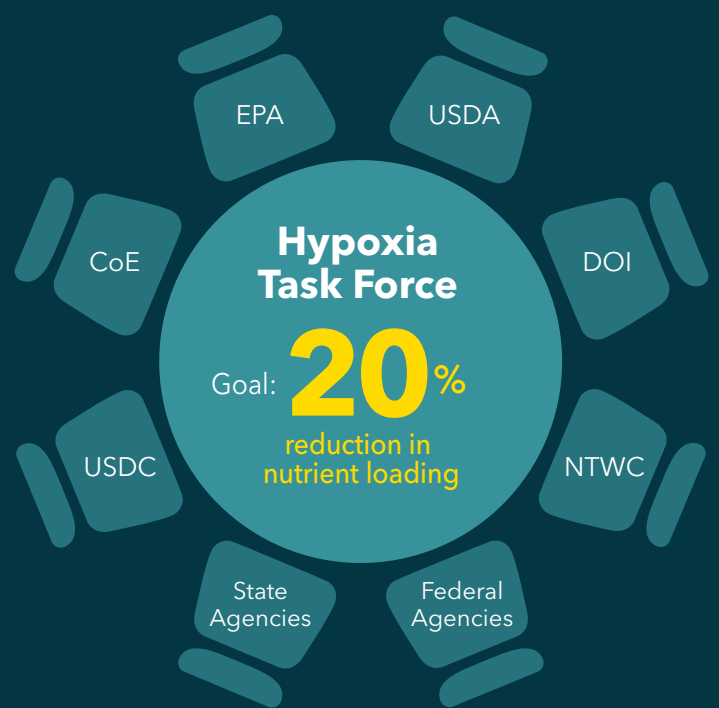
Working Together for Change

In the US, the US EPA leads a **Hypoxia Task Force (HTF)** with representatives from the Department of Agriculture, Department of the Interior, Department of Commerce, and the Army Corps of Engineers. State Representatives from Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Wisconsin, and Tennessee are also part of the solution, as is the National Tribal Water Council.

The goal of the task force is to achieve a **20% reduction in nutrient loading** in the largest hypoxic zone in North America, the Mississippi Delta by 2025.⁶

This will require a large scale, coordinated effort to reduce nutrient runoff throughout US water-bodies, setting monitoring requirements and discharge limits for nitrogen and phosphorus that wash into rivers.⁶

SOURCES:
¹ Vaquer-Sunyer and Duarte, 2008 ² Diaz and Rosenberg, 1995 ³ NOAA
⁴ World Water Resources Institute ⁵ Diaz and Rosenberg, 2008 ⁶ EPA.gov



Technical Tips

◆ TOM MOEGGENBERG



Which Turbidity Calibration Solution Should I Use?

Get the full story: bit.ly/turbiditytips

The standards used during a sensor calibration are just as important as the hardware. The manufacturers of turbidity sensors will recommend which solutions or standards are approved for successful calibration and **these approved solutions are the only ones that should be used.**

In addition, some manufacturers, like YSI, have turbidity solutions specifically made for the instrumentation they provide. Even though other solutions may appear to be the same as the manufacturer - specific varieties, in fact, are not.

YSI recommends only two types of turbidity solutions for a successful calibration. The first is AMCO-AEPA (**turbidity standards prepared and tested specifically for YSI turbidity sensors**) and the other is Formazin-based standards (either self-prepared,

purchased with specific assigned values, or purchased at high concentrations and diluted).

Please note: Formazin standards will settle so it is always necessary to follow the turbidity standard manufacturer's recommendations when handling the solution for proper suspension and dilution techniques as well as using it within the specified timeframe during calibration. The AMCO standard does not settle and is typically not recommended for performing dilutions.

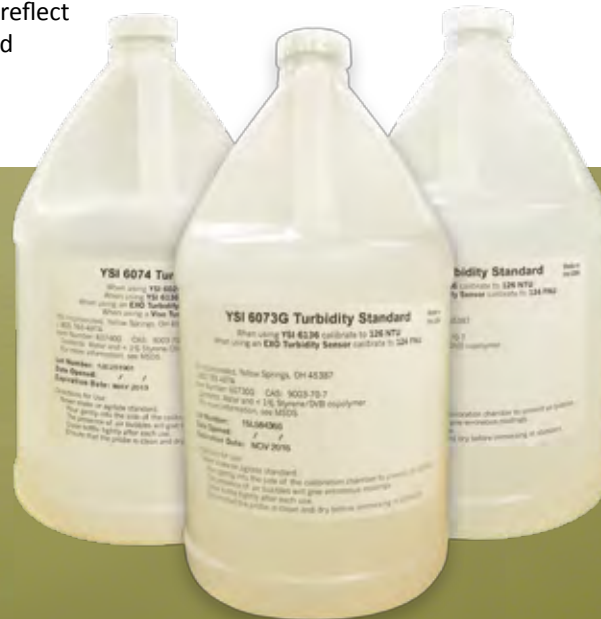
The key point is not all AMCO standards are prepared or tested in a manner that makes them conducive to calibrating all types of turbidity sensors. **The AMCO turbidity standards for YSI turbidity sensors should only be purchased from YSI.**

Other AMCO standards have not been tested to YSI's specifications and the value of the turbidity standard printed on the label of the standard does not reflect what a YSI turbidity sensor will read when placed in that standard.

Thoughts from the front line of customer support.

As a final note on calibration standards, deionized (DI) or distilled water is often used for the zeroing portion of the calibration and this is suggested to help reduce cost. The precaution here is to realize not all DI or distilled water is created equal and cannot be assumed to contain zero turbidity. DI water may register up to 1 or 2 NTU (FNU).

Using DI or distilled water for calibration and then taking measurements in waters containing low turbidity may exhibit slightly negative readings since the water that is being measured may actually contain less turbidity than the zero standard that was used during the calibration. For these applications it is typically necessary to use certified zero standards for calibration like those previously mentioned.



We recommend that YSI-certified polymer-based standards are used for best results with EXO, ProDSS and 6-Series Turbidity sensors.



GET ANSWERS: Support Contact Information

For questions regarding your YSI instrumentation:

(IQ SensorNet, Pro Series, Aquaculture, Lab instruments, EXO or 6-Series Sondes)

Email: info@ysi.com

Call: +1 (937) 767-2762

YSI Integrated Systems support:

Email: support@ysisystems.com

Call: +1 (877) 392-9950

(US) and select option #5

WaterLOG support:

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SonTek support:

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Email: help@hypack.com

Call: +1 (860) 635-1500

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Email: infousa@xylem.com

Call: +1 (937) 767-7241 x831



Your YSI Technical Support Team | Yellow Springs, Ohio

Front Row: Tyler, Samantha, Myra, Curtis | **Back Row:** Matthew, Benjamin, Tom, Ryan

? Did you know?

YSI Tech Support in Ohio took over **17,000 support calls** in 2015 and answered them in less than a minute.

YSI Tech Support in Ohio answered nearly **4,000 emails** sent to our general email box from all over the globe in 2015. (This does not include emails sent to the individual technicians email inbox.)

Developer Spotlight

Chris Palassis is a lifelong engineer with a specialty in optics and is currently the Director of Sensor Development at one of Xylem Analytics' largest R&D facilities. His main role is to explore new sensing technologies and lay the groundwork for future projects.

Chris Palassis
Director, Sensor Development



🔹 **Experience:** 8 Years with YSI, a Xylem Brand

🔹 **Alma Mater:** Montana State University-Bozeman, University of Cincinnati

xylem
Let's Solve Water

Q: How did you get your start in sensor research and technology development?

A: Going back to when I was a kid – I took everything apart to the dismay of my parents. (Laughter) It's the age-old story of people who end up becoming scientists or engineers. When I was a little older, I just started building things. At first it was go-karts, and then it ramped up into experiments with superconductors.

The natural progression was a degree in physics. I have an innate need to understand how things work, how they tick. Physics affects everything and gives those who study it a whole new outlook on the world.

Q: How did you make the transition from student to industry?

A: I finished my graduate degree at Montana State University and found an opportunity to work for Sony Electronics in their R&D department. I was responsible for designing the optics for big-screen TVs and enhancing picture quality for wide format TVs. It was a great start to my career in engineering and product development.

After a few years of work with Sony, I had a good friend from graduate school contact me about returning to Montana to work on designing lasers. The opportunity was too good to pass on and allowed me to participate in and lead several projects for NASA and the Department of Defense for remote sensing and earth science related systems. You may be surprised, but southwest Montana (USA) has the highest per capita concentration of optics and photonics companies in the U.S.

Q: What ultimately led to you joining Xylem Analytics?

A: Montana is an absolutely beautiful place that's almost like an oasis in the world. You're surrounded by nature. There's just vast open space and you can smell the pine trees as the wind blows down from the mountains. Living there for so many years, I gained an appreciation for the environment and I'm passionate about protecting it.

Years ago, I was monitoring optics job boards on a whim and I stumbled upon an opening for an optical engineer with YSI in Ohio. It was a position that I felt was almost made for me and it was also a lot closer to my family; a real win-win for me.

Q: What do you find most rewarding about your work?

A: There's something special about taking an idea, making a sketch, building a prototype, and testing if it works. Seeing a sensor go from a concept on a whiteboard to reality is an exciting experience and the most rewarding part of working here. Not every idea will be successful, but you can't find success without flirting with failure.

Q: What's your favorite part of your job?

A: The people. Well, is that too generic of an answer? (Laughter) Honestly, working with brilliant and creative people is the highlight of my day. Science and engineering can be considered by some to be very restricting work, but in reality it can be very creative in terms of solving problems from many different angles. Everyone in my team brings a unique perspective to the table and I learn something new from them just about every day.

It also doesn't hurt that I have the freedom to come to work and play around with new and exciting technology that could eventually change the world.

Q: What words of advice do you have for those interested in careers in sensor development?

A: Be a skeptic. Healthy skepticism is the only way to be successful. It's also not just about asking lots of questions, but the right ones. Don't be afraid to ask "why not?" even if it ruffles feathers. In general, product development is all about building a good mix of dreamers and realists. I'm the former.

Also, do work you believe in. YSI is an environmental company, so it's easy to see our cause and the impact on the world around us. Talk to and listen to people that use your instruments, they'll often spark great ideas in you.

" Not every idea will be successful, but you can't find success without flirting with failure. "

Photos:
Nikki Smiley Stargel Photography

What does solving water mean to Xylem employees?

It means providing the best water technology to our customers in the Transport, Treatment, Dewatering, Analytics, and Applied Water Systems fields. It means meeting our customers' expectations for product quality, on-time delivery, and customer service, so that our customers may combine our products with their expertise to solve water problems around the world.

Through Xylem's Watermark program, solving water also means going above and beyond to provide and protect safe water resources for communities in need around the world; volunteering our time and financial support to global nonprofit partners, educating communities about safe water and sanitation, and engaging the next generation of water solvers.

Watermark is Xylem's corporate citizenship and social investment program with the mission to address the world's most critical water challenges through outreach and education.

More than 60 Xylem employees have volunteered with Water for People in communities in Peru and India, to provide long-term access to safe water and sanitation facilities and education for improved hygiene practices. Partnering with Mercy Corps, Xylem employee volunteers work to provide clean water in the aftermath of natural disasters and to provide disaster risk reduction training in China, Colombia, Ethiopia, Indonesia, Nepal, and Tajikistan. Watermark has also established partnerships with Avina, China Women's Development Foundation, and EarthEcho International; providing Xylem employees with opportunities to donate or volunteer their time to help solve the global water crisis.

But Watermark doesn't only aim to solve water globally; through the new *Make Your Mark* initiative, Watermark is empowering Xylem employees to solve water locally as well.

Partnering with EarthEcho International for the World Water Monitoring Challenge, Xylem employees will engage local school children in interactive water quality monitoring education events, teaching children about the importance of water quality in their local watersheds. Through the *Make Your Mark initiative*, Xylem employees will become involved in river and beach cleanups and water quality monitoring programs.

With so many global and local opportunities for involvement, Xylem employees are prepared to volunteer 100,000 hours over the next three years. In 100,000 hours, Xylem employees can build 20,000 more water towers, monitor 25,000 waterways, and educate 500,000 children.

Xylem CEO Patrick Decker joins Planet Water Foundation to build AquaTowers and train local schools on safe water and hygiene in Cambodia.



The starting line at the Xylem China World Water Day 2015 Walk for Water

In 2015, 663 million people, nearly one in ten people, around the world lacked access to safe water supplies, while 2.4 billion people lacked access to improved sanitation.¹

Watermark works to fill these gaps; since 2008, Watermark has impacted the lives of 2.9 million people by establishing partnerships with six global nonprofit organizations, donating \$2.6 million raised through employee donations and Xylem match contributions, providing clean water and technology in the aftermath of natural disasters, and completing 893 water projects in water-stressed communities around the world.

Working with Planet Water Foundation, more than 200 Xylem employees have volunteered in Colombia, China, India, the Philippines, and Cambodia, building gravity-fed water towers and educating local school children about safe water, sanitation, and hygiene.

Starting in 2016, Watermark challenged Xylem employees around the world to volunteer 100,000 hours over the next three years to water-related initiatives in their communities and local watersheds. Xylem employees are swiftly responding to this challenge; in a month-long celebration beginning on World Water Day, March 19th and ending on Earth Day, April 22nd, thousands of Xylem employees joined their colleagues and their community in a local Walk for Water.

Every day, millions of women and children around the world walk for up to six hours to collect water; that's time not spent generating income, caring for family, or attending school.¹ The Xylem Walk for Water events raise awareness amongst Xylem colleagues and local communities, of Xylem sites, about the global water crisis and how Watermark works to solve these water problems.

¹ UNICEF/WHO 2015

At Xylem, we are excited to share our progress with you as we work to reach this ambitious goal.

Check Watermark's *Running Water* blog to read Xylem employees' accounts from their volunteer experiences. xylemwatermark.com/running-water

Visit the [Xylem Watermark website](http://xylemwatermark.com) to learn more about how Watermark is working to solve water. xylemwatermark.com



JESSICA CLEMMONS

Watermark Ambassador

xylemwatermark.com



Because Every Drop Counts

Xylem |'zilem|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xylem.com.

xylem
Let's Solve Water

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Printed on recycled paper in USA
E200v1 0616

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Minding
the Planet?®

