Science Forward--Water

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Summer Ash: The famous New York City bagel. There's an old myth about these that says "Our water is what makes them so unique." Bakers from as far away as Florida to Colorado have been building water processing systems to try and mimic the mineral content and pH of New York City's water, all in pursuit of that perfect bagel.

It turns out the secret to the perfect bagel isn't the water source. It's the preparation technique. When bakers put their recipes to the test, they found that by using the same baking techniques they could produce similar bagels, no matter where their water was from.

New York City's water is unique, though, in ways that are vital to city life. It's important that we understand the ecosystem that provides us with our water and how we manipulate and interact with it. In this video we'll explore the systems and the science behind New York City's water, where it comes from, how we use it, and what we do when we're done with it.

[music and birds chirping]

Summer Ash: When we talk about New York City's water, we're actually talking about several different systems working together to keep the fresh water flowing in and the waste water flowing out. First, let's take a closer look at our ecosystem's natural water cycle.

Water comes in a lot of forms on the planet. We have our vast oceans, lakes, and rivers and the tributaries that feed into them. There's ice on parts of the Earth's surface, water vapor in our atmosphere, and even water under the ground we walk on, in soil, and in plants.

Every day the sun fuels an exchange of energy in this water cycle, triggering weather events across our planet's surface like rainstorms, snowstorms, drought, snow melt, and more. This means water is constantly transformed through processes including evaporation, transpiration, condensation, and precipitation.

But those are just the Earth's own processes. How do we then get water from our natural surroundings into the city? Alan Frei, a scientist at Hunter College, explains.

Alan Frei: New York City water supply, the water comes from three major basins. One of them, the oldest one, is what call the Croton Basin, which is on the east side of the Hudson River. West of the Hudson River and farther north are the other two basins where most of the water comes from.

The one on the east side of the Catskills is called the Catskill System. The one on the west side is called the Delaware System because those are actually the headwaters of the Delaware River.

Bernice Rosenzweig: We don't have to pump our water for the most part, so the water flows from the reservoirs upstate. They flow by gravity from the hills upstate right down to New York City. That saves us a lot of energy.

We're also really lucky that, for the most part, we don't have to filter our water. By managing land use in those watersheds and by implementing controls on nutrient use in farms, and how sewage and sewers are handled upstate we can protect our water quality.

Summer Ash: Taking water from our ecosystem is only part of the overall picture. Humans use water but we also dispose of it. Our consumption of clean water, product of waste water, and manipulation of water systems can have far-reaching effects.

We went to Plum Beach with Brett Branco, a marine scientist at Brooklyn College, who studies the impact humans have on shoreline ecosystems.

Brett Branco: It's the gateway to Jamaica Bay so the water comes in from the lower harbor and flows into Jamaica Bay here.

The city consumes somewhere between 1.0 and 1.3 billion gallons of water per day. That's what flows from the watersheds upstate. That water that flows in gets used and then it has to go somewhere. All that water then flows into our waste systems where it gets treated and then gets discharged.

That's excellent water quality coming in. The water that goes out is loaded with all kinds of different pollutants.

Water quality is something that should be important to all New Yorkers. People should know that everyone contributes to the waste that's being put into these coastal waters. Anything that goes down the drain in their house is eventually going to end up in Jamaica Bay and end up in the East River.

Nutrients are a problem but so are lots of other things. Pharmaceutical compounds. You can measure caffeine in local waters because so much of it flows in.

When testing water, you have the three things. You're looking at the biological attributes, the chemical attribute, and also the physical attribute. The only thing you have to deal with is, "How do you distinguish if these are bad for humans or not, and how you can filter them?"

Bernice Rosenzweig: One of the biggest misconceptions that people have about water quality and water pollution is that most of our pollution and most of water quality problems are caused by some evil looking factory somewhere where there's some pipe and there's some effluent coming out of that pipe, some noxious looking substance. That's the primary cause of our water quality problems.

But because of environmental regulations, most of our water pollution really doesn't come from pipes. They actually come from the collective results of people's everyday activities.

You mentioned wastewater?

Brett Branco: Right.

Summer Ash: Where exactly is that coming from and how is it entering the water behind us?

Brett Branco: Good question. When we think of New York City's water system, we typically think of the supply end but all of that water that we use in the city has to get disposed of. Out in the water you can see a structure which basically is the end of the pipe that the wastewater treatment plant for Coney Island discharges. That water goes directly into Jamaica Bay after some treatment process.

Summer Ash: What are some methods that humans have engineered to deal with wastewater?

Alan Frei: We are in Brooklyn at the Newtown Creek WasteWater Treatment Facility. That structure that you see behind me, those are called the eggs. Those are part of the wastewater treatment facility.

The waste water treatment process is a series of physical, mechanical processes and chemical and biological processes that take basically sewage and turn it into a product that can be used for fertilization and clean water that is discharged into the surrounding waterways.

Summer Ash: Managing our water needs and wastewater production aren't the only ways that humans impact water systems. Climate change also effects water quality.

Bernice Rosenzweig: Living in the northeast, we're lucky to have our relatively wet climate so it's easy to take for granted the fact that we have so much water and that we have relatively high quality drinking water. But we have to keep in mind that there are a lot of potential shocks and stresses to the system that could jeopardize that water supply in the next couple of years or in the next few decades.

The population is expected to, at least to some extent, continue to increase. That's just more people consuming waters. Then, also, with climate change we're expecting the magnitude and the frequency of extreme events like torrential rainfall or severe and persistent droughts to increase. Those are just examples of stresses and shocks to the system that could reduce our water supply.

It's really important that even though we live in a relatively wet climate that we continue to conserve water.

Summer Ash: How do we ensure that the water we get when we open our taps is safe and reliable and that the water we put back into the system does as little damage as

possible? To do this, scientists use several methods, including constant monitoring of water quality and computer models that help us meet current needs and plan for the future.

Christopher Blaszczak-Boxe: The surprising thing that people, to put it in a nutshell, is how clean the water actually is and how much work actually is involved with getting that water from its initial origin to your house. That's a huge thing people take for granted.

Summer Ash: How often are the water plants in New York City testing their water?

Christopher Blaszczak-Boxe: They test them probably every 30 to 20 minutes, or even less. They are always testing their water constantly. They're never closed.

Alan Frei: Every single day, their computers get what we call real time data or near real time data, meaning data from yesterday or from very recently, about how much rain fell, how much snow there is, what the temperatures are, how much water was running through the streams, the water quality in the reservoirs.

They have model that takes that information and takes the criteria that the DEP has to meet for their water quality standards. They figure out how to operate the system in order to meet those critical numbers.

Brett Branco: The method that we use is called colorimetrics. You add different reagents to the water sample. It will turn a color that we can measure the intensity of that color and determine how much nutrients in the water.

Summer Ash: The color becomes a proxy, then, for the amount of the thing that you're looking at?

Brett Branco: Exactly. When you look at the chemistry of water you can't see oxygen. You can't see nitrogen so we have to come up with lots of different indirect ways of measuring how much of something is in that water sample.

Bernice Rosenzweig: A lot of my work revolves around integrating data from many different sources. When you think about doing science you think about getting scientific data sets from someone going out and taking a sample, maybe a sample of water quality or maybe measuring how much flow there is in a particular river or stream.

We're lucky that in the last couple of decades we also have data coming from remote sensing sources. That can be data from satellites in space that are providing us with a really big picture of what's going on over the entire landscape. Then beyond that, we also need to integrate that with social data sets.

You have to really understand the human perspective and what people are doing because that's going to subsequently feed back to what's happening to the environmental system.

We have so much more information to work with now that was never available before. That's really exciting. There's a lot to do.

[music]

Transcription by CastingWords