

SEBAGO LAKE

WATERSHED NEWS

WINTER 2019

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New Sebago Lake Buoy Makes Real Time Data Available to Researchers and the Public

By Dr. Ryan Dorland and Brie Holme

Do you ever wonder where the best fishing is in Sebago Lake or whether the water temperature is good for a swim? Whether you're looking for the best depth to set your fishing line or warm waters for swimming or recreating, you may be interested to know that water temperature data is uploaded to the internet every 15 minutes, May to November. These data and more, available at PWD.org or on your mobile phone through the LIVE Datacenter app, were made possible when the Portland Water District partnered with Saint Joseph's College (SJC) to install the Sebago Lake buoy. The buoy was made possible through a grant from the University of Maine¹ to support sustainable water resource management, lake research, undergraduate research training, and community engagement.

The first step in this grant project was to purchase and install the Sebago Lake buoy. Powered by solar panels and equipped with a variety of sensors, the 145-pound buoy is located at Lower Bay's deepest point. The buoy records and wirelessly transmits data on temperature, dissolved oxygen, chlorophyll (a measure of algae in the lake), water clarity, and

pH to the internet where they are available to the public and are studied by District scientists and SJC professors and students.

"We are very excited to have real-time data," stated the District's Environmental Services Manager, Paul Hunt. "Used in conjunction with monthly testing – which we've done for decades – the continuous data generated by the buoy will help us better understand the physical and ecological dynamics of the lake and will support the effective operation of the Sebago Lake Water Treatment Facility."

Dr. Emily Leshner, Assistant Professor of Sciences at SJC, stated, "Sebago Lake provides water for 15% of Maine's population, so it is critical to actively sustain this resource and better understand how it responds to challenges like climate change and development. Sustainability and wellness are campus-wide focuses at SJC, and this collaborative project is a very good fit and a step to protect this crucial water body."

The buoy's high-resolution temperature data are valuable for finding exact



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temperature conditions with depth on a given day and looking at longer-term seasonal patterns. Dr. Ryan Dorland, Assistant Professor of Sciences at SJC, has been using the temperature data to create “heat maps” to study how the lake reacts to changing weather conditions. Heat maps are a way of plotting the data with temperatures represented as colors (Figure 1). What did we learn from the buoy’s temperature data this year? The maximum lake temperature for the summer reached 81.3°F on August 8th at 4:00 p.m.. This was after a particularly warm several days where air temperatures were in the high-80s and low-90s. A frontal system and rain event moved through the area starting on August 8th, lowering air and lake temperatures after this peak.

Additionally, the buoy’s temperature data give us insights into the dynamics of the lake’s stratification. Stratification refers to layers of the lake that set up in the spring, with a layer of warmer and less dense water on top and colder, more dense water on the bottom. These layers of lake water do not mix all summer, until the fall when the top layer cools enough to mix with the bottom layer. The depth of Sebago Lake and its size make it similar to other large lakes, where the seasonal stratification of temperature sets up in the upper 30 to 40 feet of water depth due to heat from the sun and warm air temperatures starting in May (the blue arrow on the heat map points to the early part of May when the lake

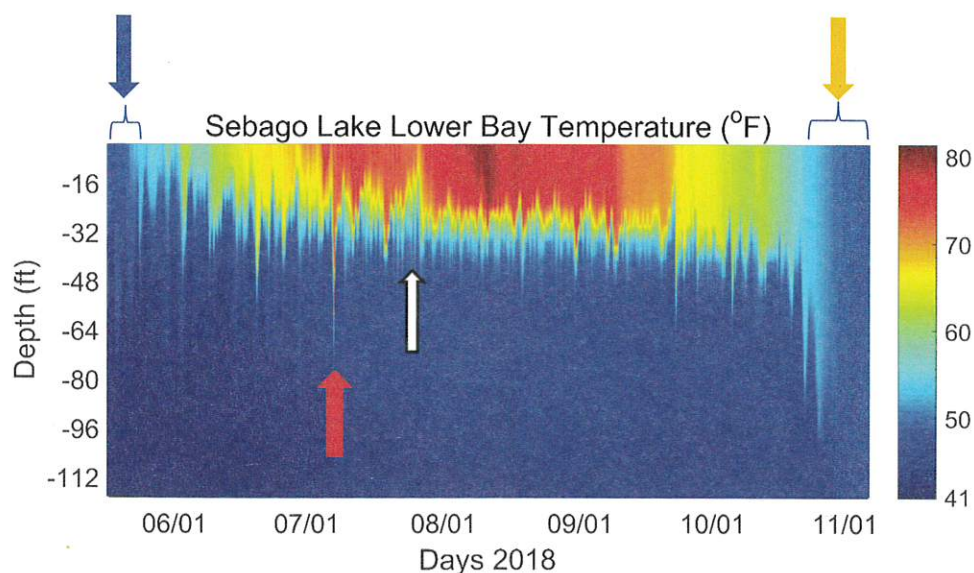


Figure 1. Temperature in Sebago Lake, Lower Bay from May 16 to Nov. 5, 2018. The depth is measured from the surface with the first measurement starting at three feet below the surface.

is not yet stratified, as indicated by the blue color from top to bottom). We like to think of this stratification as a uniform feature in lakes during the summer, but wind and storm events, along with changes in daily solar heating and air temperatures, can make the depth of this warm layer move considerably. The buoy data, combined with weather stations around the lake and at SJC, allow us to capture just how dynamic Sebago can become and how the lake responds to rapid weather events. A large storm event with sustained winds of >30 mph on July 6th forced 67°F warm water to a depth below 50 feet where typically the average temperature for this depth is 46°F (red arrow on the heat map). Within twelve hours, the warm water depth had rebounded back to above 30 feet after the winds subsided. A few days later, this warm layer was as shallow as 15 feet due to different wind and temperature conditions (black and white arrow on the heat map).

The minimum lake temperature near the bottom was observed near mid-May at 41°F. Slowly the bottom waters warmed throughout the summer towards 44.3°F in September. Once the stratification breaks down in the lake and vertical mixing occurs in late-fall or early-winter, temperatures will return to 41°F or even go as low as 39.2°F, the temperature at which freshwater has

its maximum density. During 2017, the late October storms which led to property damage and power outages in the region significantly contributed to the breakdown of stratification in the lake. We observed a more gradual breakdown of stratification in 2018 due to winds and decreasing air temperatures (yellow arrow on the heat map). When the buoy was removed on November 5th, Lower Bay had a near-uniform temperature of 48°F at all depths. Over the course of years and decades, these data will help us monitor the impacts of changing weather and climate on the physical environment and water quality of the lake.

*A grant from the Department of the Interior, U.S. Geological Survey through the Mitchell Center for Sustainability Solutions, University of Maine, under Grant No. G16AP00057.



Leshner and Holme on deployment day



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Native Plant Spotlight

By Kirsten Ness

Protect your shorefront and help bees and butterflies at the same time!

There has been a decline in pollinators over the last few decades for a number of reasons. You can help pollinators such as bees and butterflies by planting some of the following plants on your property. These plants will also help stabilize soil and reduce erosion at the same time. It's a win-win!



Kirsten Ness is a water resources specialist at the Portland Water District. She can be reached at kness@pwd.org



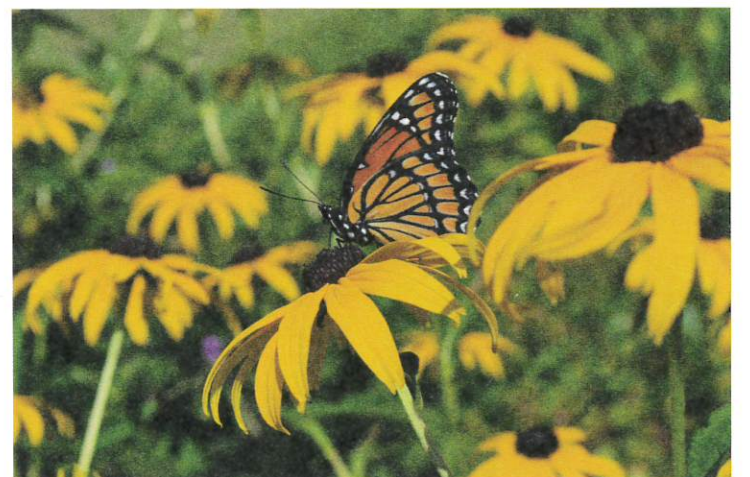
Joe-Pye Weed (*Eupatorium maculatum*) Joe-Pye weed is one of the most popular plants for attracting bees and butterflies. It is also an excellent plant for stabilizing soil and preventing erosion. It prefers sunny conditions and moist soils.



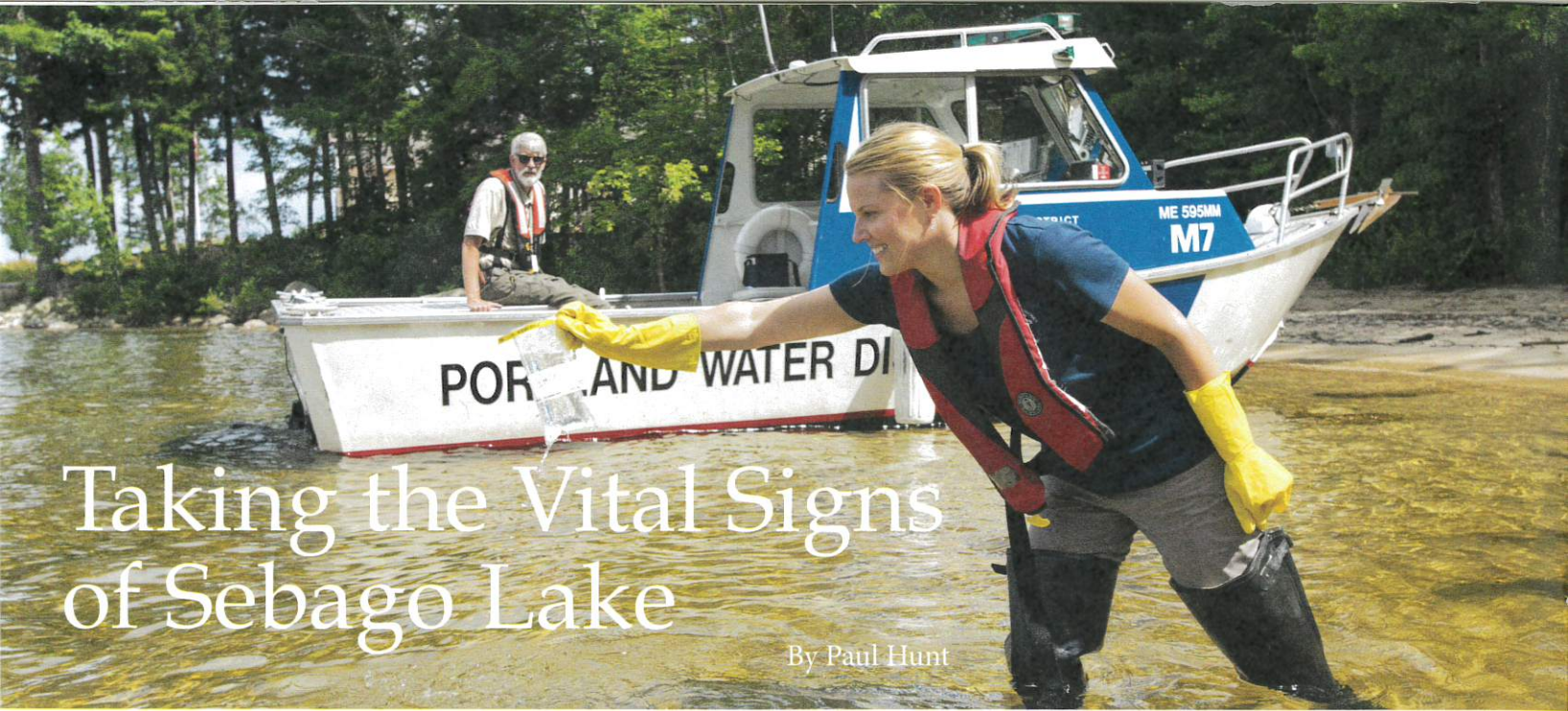
Swamp Milkweed (*Asclepias incarnata*) There are many species of milkweeds, but swamp milkweed is one of the best for use in gardens. It is highly attractive to Monarch butterflies. Swamp milkweed tolerates sunny to partly sunny conditions and moist to wet soils.



Purple Coneflower (*Echinacea purpurea*) There are many beautiful cultivars of coneflower at the nursery, but many of them are not beneficial to pollinators. The native coneflower is pink/purple in color and has an orange/brown center. If you plant a variety of coneflowers be sure to include the native variety! It prefers sunny areas and dry soils.



Black-eyed Susan (*Rudbeckia hirta*) Common black-eyed Susan provides great color in the garden, while also attracting pollinators. It prefers sunny areas with moist soils.



Taking the Vital Signs of Sebago Lake

By Paul Hunt

The federal Safe Drinking Water Act requires that we maintain a Watershed Control Program. Ours has six main components. They are:

1. Water Quality Monitoring
2. Security
3. Inspection and Direct Actions
4. Environmental Education
5. Environmental Outreach
6. Land Acquisition, Land Conservation and Land Management

Here's a brief description of the first component of the program:

Water Quality Monitoring

When you go see your doctor, one of the first things he or she will do is ask how you are and take a series of measurements - height, weight, and blood pressure are three common ones. Why do these matter if you're there, say, because you have a rash or because you fell?

Because your body is a complicated organism, the doctor does a few simple tests to see if outward signs indicate that everything is functioning normally. A gain or loss in weight since your last visit may be easily explained - maybe you started running - or it may be an indicator of an illness that you didn't realize you had. If your vital signs look in any way unusual, your doctor may order other, more specific tests to diagnose the problem.

Portland Water District's nine most significant water quality monitoring programs are designed with a similar purpose. The lake is a complex, living system, too, and by taking measurements of vital signs in the lake itself and in the streams and rivers that flow into the lake, we can get an indication of the lake's health on the day we visit. When we see unusual numbers, we do follow-up sampling or investigate conditions on the ground to try to identify and correct the problem.

Here is a list of these nine programs and a brief description of what each is for. The good news is that by virtually every measure the lake is healthy and stable or improving in quality. But, like a good doctor, we will continue to test its vital signs with each visit.

Program	Brief Description
Lake Profiles	Classic lake monitoring conducted at the deepest parts of the lake from May to October
Tributaries	Year-round monthly testing of the largest rivers and streams that feed the lake
Crooked River	More involved testing of the lake's most important tributary conducted four times per year
Periphyton	An annual assessment of the growth of attached algae near the shore of the lake
Macroinvertebrates	An annual collection of insects in three of the lake's tributaries
Swimming Beaches	Tests for E. coli at public and private swimming beaches from samples collected weekly during the summer
Lower Bay Bacteria	Tests for E. coli at locations inside the No Body Contact Zone in Lower Bay from samples collected monthly during the open water season
Zooplankton Monitoring	An assessment of the number and types of zooplankton in samples collected at the deepest part of Lower Bay during the open water season
Algae Monitoring	A year-round monthly assessment of the number and types of algae in raw water

You can get more detail about the programs and some of the historical data by visiting the publications page (technical reports) on our website here: <https://www.pwd.org/publications>

You can view a short video about our water quality monitoring programs here: <https://www.pwd.org/videos>



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Route 35 Reconstruction Project

By Chad Thompson



Chad Thompson is the source protection coordinator at the Portland Water District. He can be reached at cthompson@pwd.org

As commuters through the area likely observed, the Maine Department of Transportation (MDOT) recently completed a major reconstruction of Route 35 along the southern end of Sebago Lake. While the road was previously known to be dangerous to drivers, especially in the winter due to its many dips, slopes, and humps, the newly upgraded road is much safer. Several of the improvements also protect water quality since vehicle accidents

along this section of road have the potential to contaminate Sebago Lake. Over the past several years, the District's staff worked with MDOT engineers to review and make recommendations on the reconstruction plans for the Route 35 project. Recommendations that were incorporated into the project and in some cases paid for by the District include:

- Directing stormwater to the side of Route 35 that is farthest from the lake
- Moving the intersection of Routes 35 and 237 to the east so that the corner no longer points directly toward a lake viewing area adjacent to the shores of Lower Bay
- Adding a turning lane for traffic taking a left onto Route 237
- Improving the site distance to the southwest of the intersection with Route 237

The District also monitored the construction of the new roadway along the southern end of Sebago Lake during the summer of 2018 to ensure that temporary erosion control measures used by the contractor were installed and maintained. Overall, the District was impressed with the design and project management team from MDOT, as well as the construction work by Shaw Brothers.



Moving the Rte. 35 and 237 intersection



Level lip spreader installed to prevent ditch erosion



New lake viewing area provided through a partnership between MDOT, PWD, and the town of Standish

WHAT'S MAKING WAVES AROUND SEBAGO LAKE

STANDISH BOAT LAUNCH SHED

The District and the Town of Standish recently installed a new structure at the Standish Boat Launch. The small building, located over 100 feet from the lake, is serving as a centralized location for District security staff and Standish launch attendants. It also houses emergency spill response equipment, safety gear, and other necessary items that were previously transported to the launch on a daily basis. District security staff work at the boat launch from the spring through the fall, ensuring that boats are being launched safely and performing courtesy inspections to check for invasive plants.

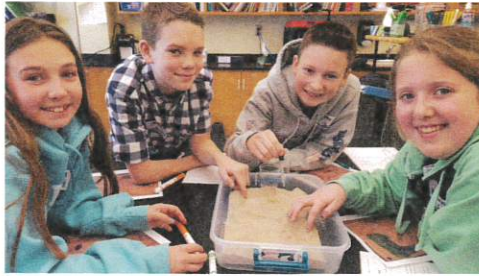


The District's new boat launch shelter

SCHOOL EDUCATION PROGRAMS

The District has implemented in-school education programs about water quality protection for over twenty years. Our largest program, WaterWays, is provided to sixth grade science classes in towns around the watershed and the towns we serve. The District educator visits classrooms once a week for four consecutive weeks, providing hands-on science lessons about the ways we use, share, protect and could pollute water. In order to participate, teachers must be covering related curriculum at the same time as program delivery. This method provides strong student retention and understanding of these important and complex topics. All lessons have been aligned to national science standards and additional teaching resources are shared with teachers so they can carry the lessons even further. To support our efforts, educators at Cumberland County Soil and Water Conservation District and Lakes Environmental Association will be

delivering WaterWays in two additional schools during the 2018-19 school year. Running from October through April, WaterWays will be delivered at eight schools reaching approximately 1,100 students. To learn more, check out our recent video about WaterWays at <https://www.pwd.org/videos>.



Students learn about watersheds in the WaterWays Program

WOODS, WATER, AND WARBLERS

Sebago Lake's watershed, about 85% forested, deserves much of the credit for the lake's exceptional water quality. The folks who own and manage those forests are to be thanked for how well they have protected those forests for decades. This past August, the District invited woodland owners and consulting foresters from the watershed to an event, Woods, Water & Warblers. The event included a trail walk at Intervale Preserve in Harrison, followed by a reception at Harrison Elementary School. Partners from Lakes Environmental Association, Maine Forest Service, Maine Audubon, University of Maine, Loon Echo and Western Foothills Land Trusts, Maine Woodland Owners Association, and Integrated Forest Management facilitated the walk by highlighting each organization's ability to serve as a resource to woodland owners.



The walk portion of the event occurred at Crooked River Forest at the Intervale Preserve in Harrison, and included stops during which the District and partners shared helpful resources for woodland owners.

SEBAGO CLEAN WATERS EARNS GRANT

The District is a member of the Sebago Clean Waters partnership. Comprised of several regional and national conservation groups, the partnership seeks to protect water quality in the Sebago Lake watershed through voluntary forestland conservation. In the spring of 2018, the group was awarded a \$350,000 grant from the U.S. Endowment for Forestry and Communities to continue their work in the watershed. The grant award will be used to increase collaboration among Sebago Clean Waters partners, private landowners, communities, and water users. The grant will also be used to develop and launch a water fund that will enable downstream water users to invest in upstream land conservation.

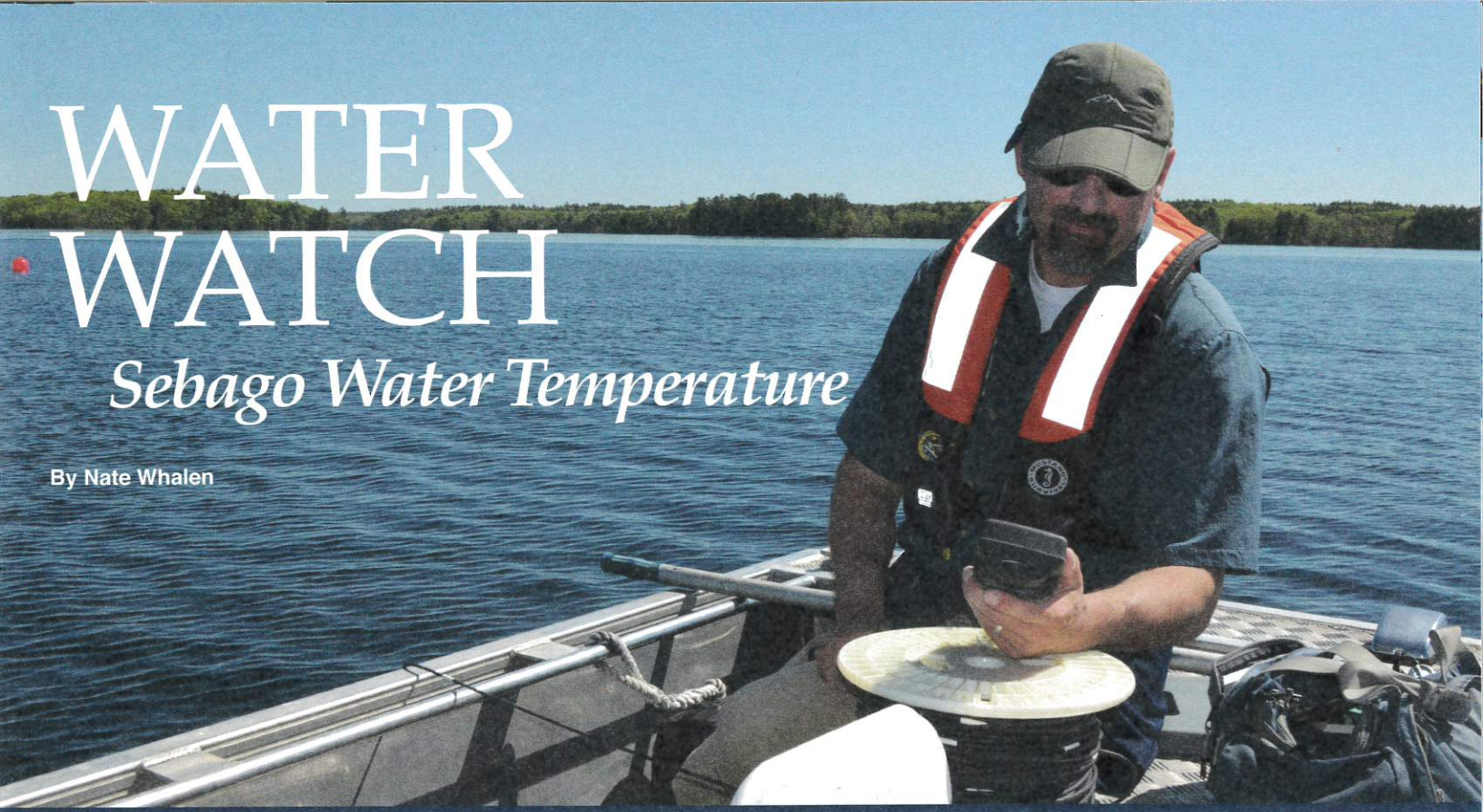
FORESTRY ON DISTRICT LAND

As passers-by might have noticed, a significant amount of tree harvesting was completed this summer near the intersections of Rt. 35 and Rt. 237 in Standish. The District's Forest Management Plan calls for periodic thinning of trees and this was done in conjunction with the MDOT Route 35 road construction project. The District manages approximately 2,500 acres of forest around the lower bay of Sebago Lake and the Forest Management Plan guides the manner in which these woods are maintained. The most important goal of the plan is protecting the water quality of Sebago Lake. Although we're aware that the recently cut forest doesn't always look attractive, protecting water quality requires periodic logging to maintain three levels of forest cover, to make fire less likely, and to create openings in the forest canopy so that younger seedlings can grow.

WATER WATCH

Sebago Water Temperature

By Nate Whalen



A woman I know who often swims in Sebago Lake told me that the lake water seemed warmer than normal this summer. I've heard comments similar to this one before - comments like, "I've been coming here for 30 years and have never seen the lake so _____ (fill in the blank - warm, cold, clear, cloudy, high, low). I try to pay attention and keep an open mind to peoples' observations because first-hand observations can provide unique insight. I also seek to verify observations with data when I can. The lake did seem warm to

me this summer, too. And in the case of temperature we have some historical data we can use to test the validity of this observation. We have measured the lake surface temperature for almost 30 years. Was it really warmer this summer? If so, is this a trend or an unusual year? I decided to look into it.

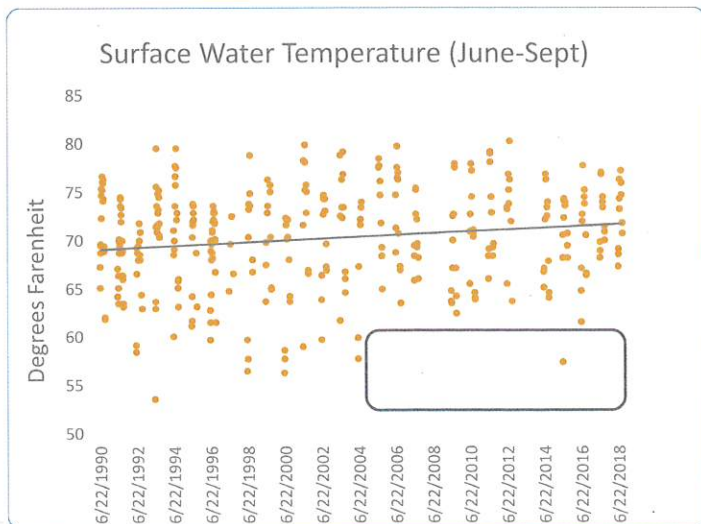
The data show a few interesting things. First of all, the woman who thought the lake seemed warmer was right. The data show that lake surface temperature

is trending incrementally upward. The average summer surface temperature has risen from 69 to 72 degrees F since we started taking measurements in 1990. Looking more closely at the data reveals an interesting thing: the maximum hottest temperature hasn't gotten warmer over that time, but the cooler temperatures

are not as cool as they were. The lake is gradually warming up earlier in the year and cooling down later.

If these changes are part of a larger regional trend related to longer and hotter summers there may not seem to be much you (and we) can do to reverse it. But there is one thing that could help minimize higher temperatures: trees and other plants. The water flows to the lake over the land around it. Water flowing to the lake through forested and vegetated land will be cooler when it reaches the lake than water flowing over paved land or wide, green lawns.

If you own forested land in the watershed, that's another good reason to maintain those woods. If you own an individual residence, establishing and maintaining buffer plants, trees, and shrubs in your yard will similarly result in cooler water running off your land to the lake. And you'll have less lawn mowing to do.



Notice the absence of cooler temperatures in recent years, inside the purple box.



Nate Whalen is a water resources specialist at the Portland Water District. He can be reached at nwhalen@pwd.org

Protecting a Trillion Gallons of Water – A Video Series

By Carina Brown

In early 2018, the District's Lake Office staff began planning and filming for a six-part short video series, entitled, Protecting a Trillion Gallons of Water. Lake Office staff includes eight year-round employees who together protect Sebago Lake, the source of drinking water for 200,000 Mainers, through a "Watershed Control Program." The video series highlights five key components of the Watershed Control Program, with one video dedicated to introducing the series and each of the five other videos dedicated to describing one component.

The series was completed at the end of 2018. Each video debuts on our Facebook page (<https://www.facebook.com/MyPortlandWater>) and is available on our YouTube channel (<https://www.youtube.com/user/MyPortlandWater>) and the District's website (www.pwd.org/outreach).

The videos are described below:

- | | |
|------|---|
| May | Part 1: Introduction to Source Protection |
| July | Part 2: Lower Bay Security & Land Management |
| Sept | Part 3: Water Quality Monitoring |
| Oct | Part 4: Environmental Education: Water Ways |
| Dec | Part 5: Sebago Lake Land Reserve Forest Management |
| | Part 6: Land Conservation |



Chief of Security describes PWD's security program



Carina Brown is an environmental educator at the Portland Water District. She can be reached at cbrown@pwd.org

Reducing Erosion and Runoff at Camp O-AT-KA

By Kirsten Ness

Camp O-AT-KA is located on the shorefront of Sebago Lake in the town of Sebago. The camp's property is on a hillside that slopes steeply down to the lake. Over the years, the camp has dealt with stormwater running down the hillside, throughout the camp, and causing soil erosion along the way. This summer the camp was eager to fix some of these problems. Fortunately, the District and the Cumberland County Soil and Water Conservation District (CCSWCD) had some money available through a federal Clean Water Act grant; a grant that was designed to protect the water quality of Sebago Lake. CCSWCD evaluated the stormwater runoff at the camp and provided numerous recommendations for reducing erosion and infiltrating stormwater runoff. Over the last few months the camp has completed the following projects: installation of Geoweb (plastic webbing) filled with crushed stone to stabilize an eroding roadway, enhancement of existing infiltration steps, definition of walkways with crushed stone and mulch, and installation of a crushed stone trench in front of the Great Hall to absorb roof runoff. The camp reports that these projects have helped to significantly reduce the amount of runoff flowing into Sebago Lake.

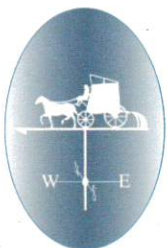


Before – eroding hillside



After – hillside stabilized with Geoweb filled with crushed stone

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The Sebago Lake Watershed News is published by the Portland Water District.

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