

Sebago Lake

STATE OF THE LAKE

REPORT

2015

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PHOTO: KATHY MAXSIMIC

Introduction

Sebago Lake is an outstanding water supply. There are nearly 12,000 water systems in the country that use a lake or river as a supply, and in all but about 50 of them the water must be filtered prior to disinfection. Sebago Lake is one of those 50 that doesn't require filtration. The mostly forested watershed provides clean, clear water to the large, cold, and deep lake.

The Portland Water District (PWD) monitors activities on the land and tests the water to track changes in water quality over the long term. This report summarizes some of the data we track.

Lakes are complex systems and although climate change has already begun to affect Sebago Lake, its future effects on the lake are not easily predicted. Because the lake is so clean and deep to begin with, it is more resistant to change than a smaller, shallower lake.

This is the fifth edition of the State of the Lake Report prepared by the Portland Water District. It provides a snapshot of the condition of the lake through 2015. You can view some past reports on our website (www.pwd.org) and share your comments or ask questions at Sebagolake@pwd.org.



PHOTO: TODD BELLO



PHOTO: KERRY FREEMAN



PHOTO: SUZANNE WHITE

Winter ice is forming later and melting earlier on Sebago Lake and our total annual precipitation is increasing (Figures 1 & 2). These are two ways climate change is affecting the lake and they both could lead to an increase in algae. Algae are single celled microscopic organisms that live in the water and act like plants. They use sunlight and the naturally-occurring nutrient phosphorous for growing and reproducing. Just as with a garden, some conditions can lead to more growth. Algae can bloom and turn lakes green. The longer period of open water gives algae an

extended growing season. And more rain and more frequent extreme storms mean more phosphorus-rich soil washes into the lake where it can feed the algae.

The good news is that Sebago Lake is not in danger of turning green from an algae bloom any time soon. Sebago is naturally clean and clear. The watershed is mostly forested, which acts to filter and absorb the rain water. By conserving forested land and ensuring that lots around the lake are developed responsibly, we can make it easier for the lake to adapt to the future effects of climate change.

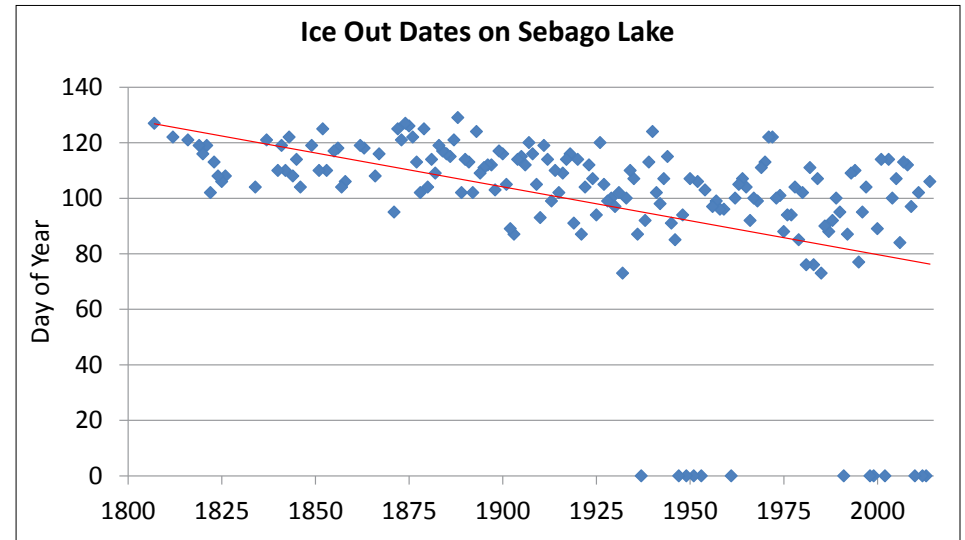


Figure 1: Ice out dates (number of days past January 1st) for Sebago Lake, 1807-2014. The blue diamonds plotted at the bottom of the chart on the zero axis indicate years when Sebago did not freeze over completely.

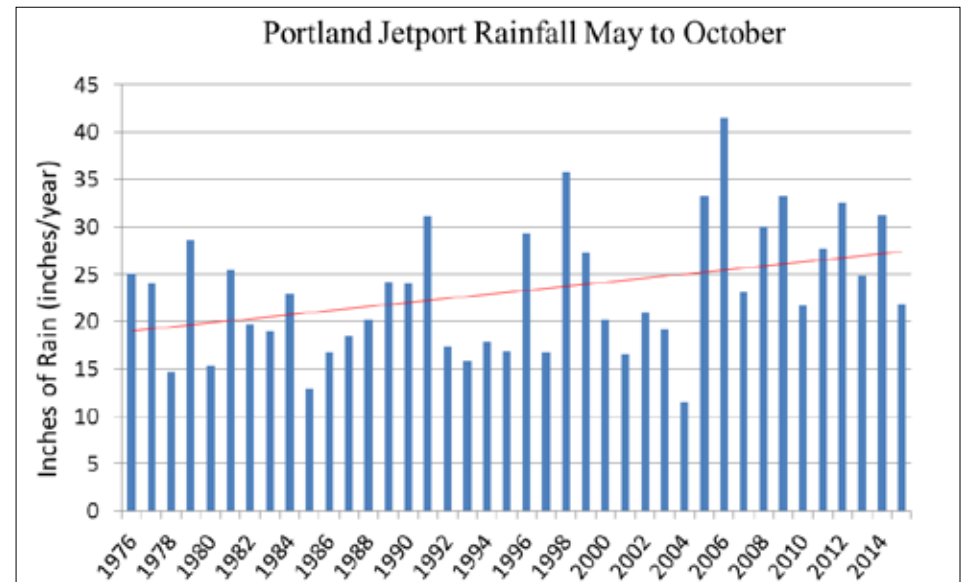


Figure 2: The rainfall at the Portland Jetport has been on an increasing trend since 1976.

The quality of water in Sebago Lake is important to all who use the lake, own property near it, or drink it. PWD has been monitoring the health of Sebago Lake and the land surrounding it (the watershed) for decades. This monitoring effort includes sampling of tributaries, near-shore locations, deep basins of the lake, and many locations around the water intakes in Lower Bay. While PWD performs many chemical and physical tests on lake and stream waters, this article focuses on just two measures of water quality - lake clarity and bacteria. Monitoring these and other parameters in the lake and watershed allows changes in water quality to be detected before they impact the quality of water consumed by the public.

LAKE CLARITY

One of the ways to determine the health of a lake is to measure the clarity of the water. Clarity is measured by lowering a black and white disk, called a Secchi disk, down into the water and recording the depth at which the disk

disappears. The deeper the disk is visible, the clearer and cleaner the lake. And Maine lakes are among the cleanest lakes in the nation.

Sebago Lake is one of the cleanest and clearest lakes in Maine. By any measure, Sebago Lake water quality is outstanding. Figure 3 shows the fluctuations in lake clarity since 1976 (the red line) and the annual rainfall measured in Portland (blue bars). Note the close correlation between lake clarity and rainfall amount. When there is more rain the lake water is less clear.

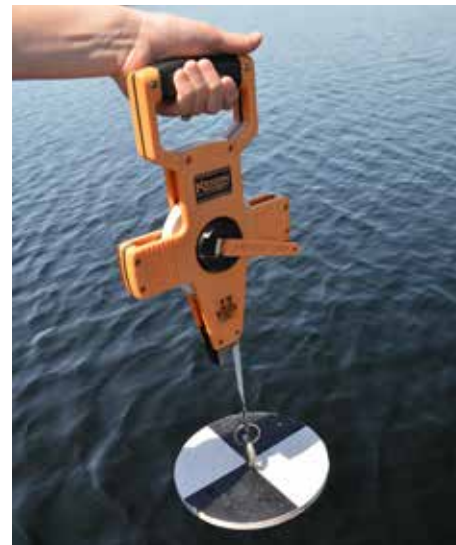
How might rainfall be related to water clarity? Rain water washes pollution such as soil, bacteria, and fertilizer, into the lake. Though there is no way to control rainfall, keeping land forested as much as possible and developing properties around the lake with an eye toward preserving some of the vegetation on the lot can help keep soil from washing into the lake when it does rain.

Clean, clear water is important to the Portland Water District because Sebago Lake is the drinking water supply for the greater Portland area.



Sampling lake water to be tested for *E. coli*

PHOTO: MARK HUNT



Secchi Disk

PHOTO: MARK HUNT

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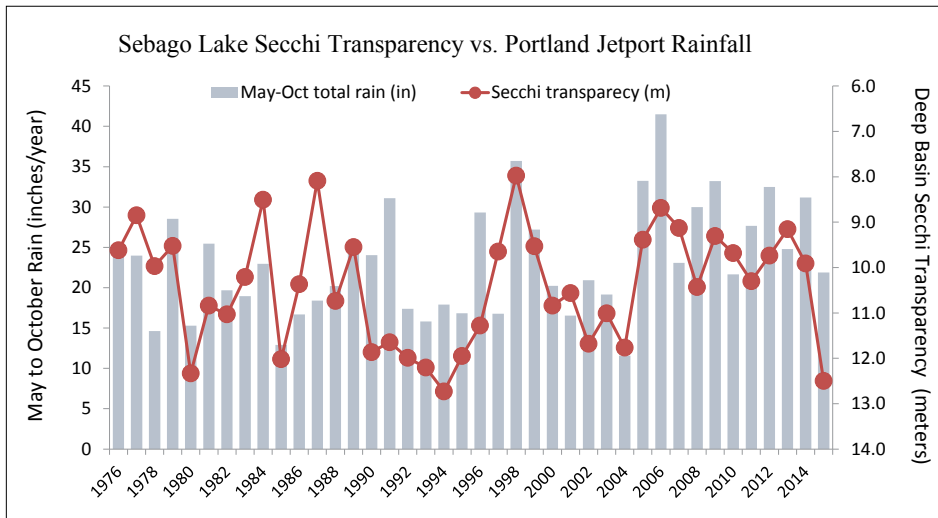


Figure 3: Sebago Lake Secchi depth is presented as annual averages. Please note that the vertical axis is reversed so that larger numbers appear at the bottom of the graph meaning greater lake clarity. Note that the 2015 sampling season was very dry until October.

In addition, clean water is important to the people who own property around Sebago Lake. A study by the University of Maine showed that property values are related to water clarity. Property values are higher on lakes with clear water and lower on lakes with water that is less clear.

LAKE BACTERIA

An important way to determine the quality of water for drinking is to measure bacteria in the water. Bacteria are present throughout our environment and while many are not

harmful, some can cause illness. Weekly during the summer months, PWD monitors *E. coli* levels at beaches around Sebago Lake. *E. coli* is a type of fecal coliform bacteria found in the gut of warm blooded animals. Samples are taken at beaches within the 2-mile no bodily contact zone and at swimming beaches outside the no bodily contact zone. *E. coli* levels are much lower at beaches where humans are not allowed to swim (Figure 4). Minimizing *E. coli* in the lower bay of Sebago Lake is important

to ensure that safe, clean drinking water is delivered to the public.

Overall, the water quality of Sebago Lake is high and, based on the data, there is no cause for alarm. However, the lake is not invincible, and we all have a role to play in protecting Sebago Lake.



Taking a Secchi reading

PHOTO: MARK HUNT

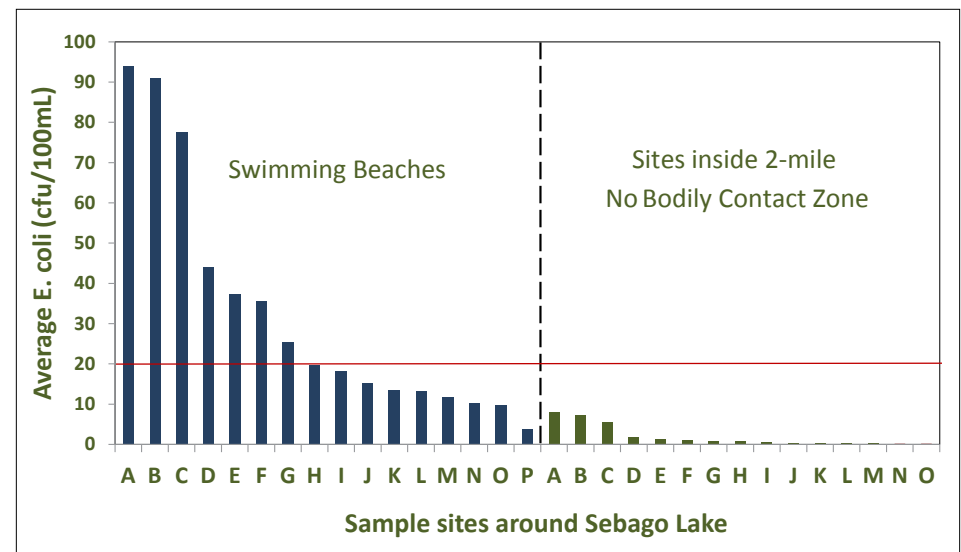


Figure 4: Fecal coliform bacteria around Sebago Lake from 1979-2014 for swimming beaches (blue bars) and sites within the 2 mile no bodily contact zone (green bars). The horizontal red line shows the legal limit for fecal coliform bacteria in unfiltered raw water under the Safe Drinking Water Act.

We are lucky that Maine has such wonderful lakes, rivers and streams where we can recreate and enjoy nature's beauty. Sebago Lake is one of the largest, deepest, and clearest lakes in Maine. The water in Sebago Lake is so clean that the Portland Water District is able to use it as an unfiltered drinking water source for over 200,000 people. The excellent water quality is largely a result of the forested watershed.

According to analysis conducted via aerial photography, 82% of the Sebago Lake watershed is forested. Forests produce great water quality because they have multiple ways of stopping pollutants from getting into water bodies. First, the forest canopy slows rainfall which prevents large surges of rainwater from eroding soil and carrying it to the lake or to streams that feed the lake. Water that lands on the forest floor is absorbed by the leaf litter layer and absorbed into the ground where it is taken up by the roots of trees and other plants in the forest. By contrast, developed landscapes with hard, smooth surfaces like roads, parking lots, roof



Flint Farm, Albany Township



Watershed view from Mt. Tire 'm in Waterford.

tops, and driveways, add toxins and bacteria to water, speed up runoff, and cause soil erosion. Studies have shown that lake water quality begins to show signs of decline when watersheds drop below 75-80% forest.

In addition to being highly forested, the Sebago Lake watershed is approximately 91% privately owned.

There is land that is conserved - state parks, properties conserved by land trusts, and national forest lands - but together that makes up only about 9% of the watershed. The best way to maintain forest would be to own all the land in the watershed. This is not feasible nor is it desirable for PWD because the Sebago Lake watershed is almost 300,000 acres in size.

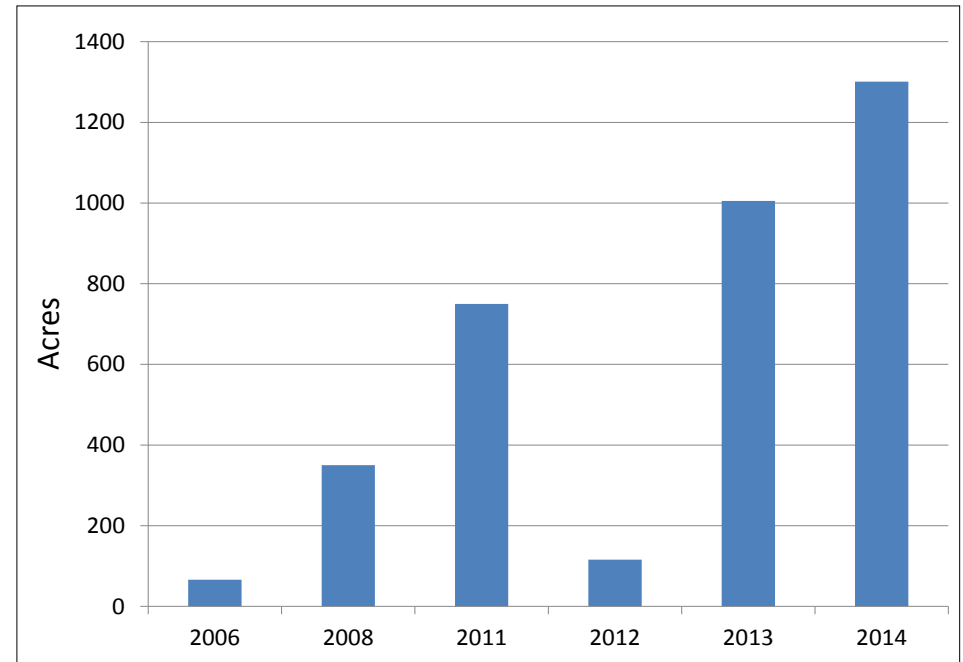


Figure 5. Acres conserved each year in the Sebago Lake watershed. As of 2016 there are approximately 25,000 acres conserved in the entire 280,000 acre Sebago Lake watershed.

Instead, PWD works with land trusts and other conservation organizations to encourage private land owners to conserve their forestland. ***In the past 4 years, PWD has contributed to the conservation of almost 4,000 acres of land in the watershed.*** By conserving forested land, we work towards ensuring clean, abundant drinking water for years to come.

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WATERSHED DEVELOPMENT

Why is the rate of development important to Sebago Lake health? Development around the shoreline of a lake changes the way water moves across the landscape. While the forest floor slows, absorbs, and filters water, developed landscapes have smooth, hard surfaces that speed up runoff which picks up soil and other pollutants along the way. Over time, an increase in the amount of developed land can lead to a decrease in lake water quality.

WHAT ARE THE TRENDS IN DEVELOPMENT SINCE 2002?

There are seven towns that have shore frontage on Sebago Lake: Standish, Sebago, Casco, Naples, Raymond, Windham, and Frye Island. Because they are right on the shore of the lake, development of watershed properties in these towns has the greatest potential to affect Sebago Lake. The total Sebago Lake watershed land area in these seven towns is 86,440 acres, ranging from 862 acres in Frye Island to 20,452 acres in Naples.

In an effort to evaluate the rate of watershed development in these towns, building permits on file at the town offices were reviewed and compared to previous years. Numbers of building permits in Figure 6 reflect those permits in the Sebago Lake watershed for new construction or improvements with an estimated value equal to or greater than \$50,000. These totals give an indication of the numbers of previously undeveloped properties which were developed in each year. Development slowed during the economic downturn following 2008, though it appears to be rebounding.

Another way to measure development directly around the lake is the number of new septic systems that are installed each year. A PWD per-

Development around the shoreline of a lake changes the way water moves across the landscape.



PHOTOS: MARK HUNT



mit is required for the replacement, expansion, or installation of a new system within 200 feet of Sebago Lake. Figure 7 shows the number of new systems installed since 1997. New systems are a measure of development of previously undeveloped lots on land closest to the lake. The number of new systems has been below 10 per year since 2008, most likely a result of the economic downturn, as well as the decreasing number of undeveloped lots available on Sebago Lake.

Building Permits for New Construction

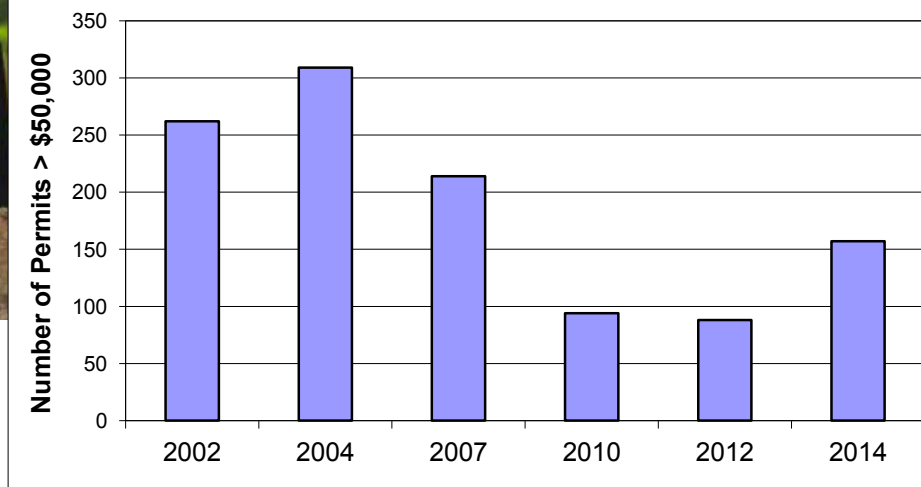


Figure 6: Number of building permits for new construction projects in the watershed for the towns of Casco, Naples, Windham, Raymond, Standish, Sebago, and Frye Island.

New Septic Systems Within 200 Feet of Sebago Lake

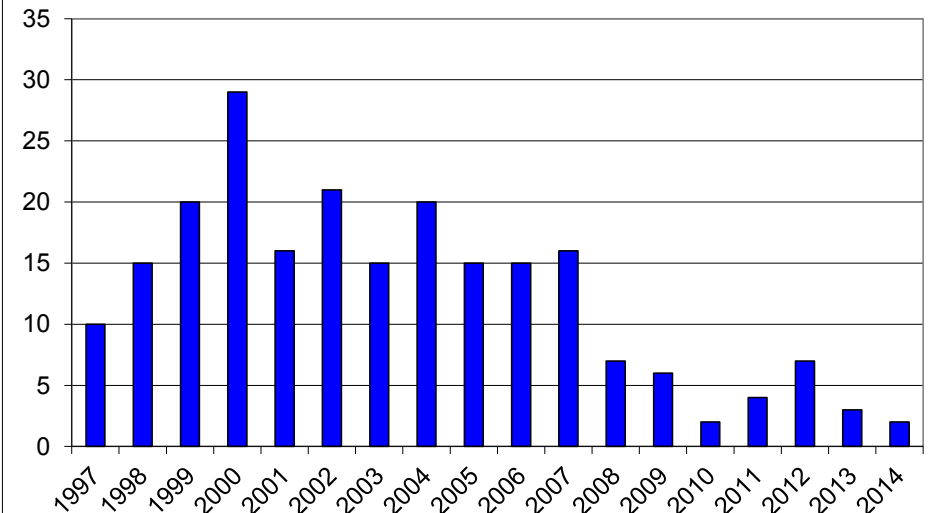


Figure 7: Number of new septic systems within 200 feet of Sebago Lake per year.



PHOTO: MARK HUNT

Water leaves Sebago Lake through the Presumpscot River to Casco Bay. The Eel Weir Dam was first built at the head of the Presumpscot River at the outlet of the lake around 1827. The dam was later raised to its present height in 1884 and is managed today by the South Africa Pulp and Paper Company (SAPPI) which owns S.D. Warren Company. According to the Maine Department of Environmental Protection, the lake is nine feet higher now than it was before the dam was completed. As with

every dam that generates power, the Federal Energy Regulatory Commission (FERC) oversees and licenses the operation of the dam.

FERC issued a new license on March 23, 2015. The new license includes requirements for managing the level of Sebago Lake through the course of the year. Under the new license, S.D. Warren will attempt to fill the lake to 266.00 feet above mean sea level – referred to as MSL - between May 1st and June 15th. If the level goes above 266.65 ft. MSL, the

dam will be opened to lower the lake and if the level goes below 262.00 ft. MSL, the dam will be closed to raise the lake level. Any time the lake is between those two levels, no adjustments will be made.

This new way of managing lake level is expected to more closely mimic a natural, undammed lake. Lake level will be higher when it rains a lot and lower when it doesn't. The Portland Water District supported the new lake level management requirements because there is no evidence that it

would negatively impact lake water quality and because it would release more oxygen-rich water to the Presumpscot River during the summer months when the river can experience low oxygen levels.

This new way of managing lake level is expected to more closely mimic a natural, undammed lake.



PHOTO: KENDRA RAYMOND



PHOTO: KATHY MAXSIMIC

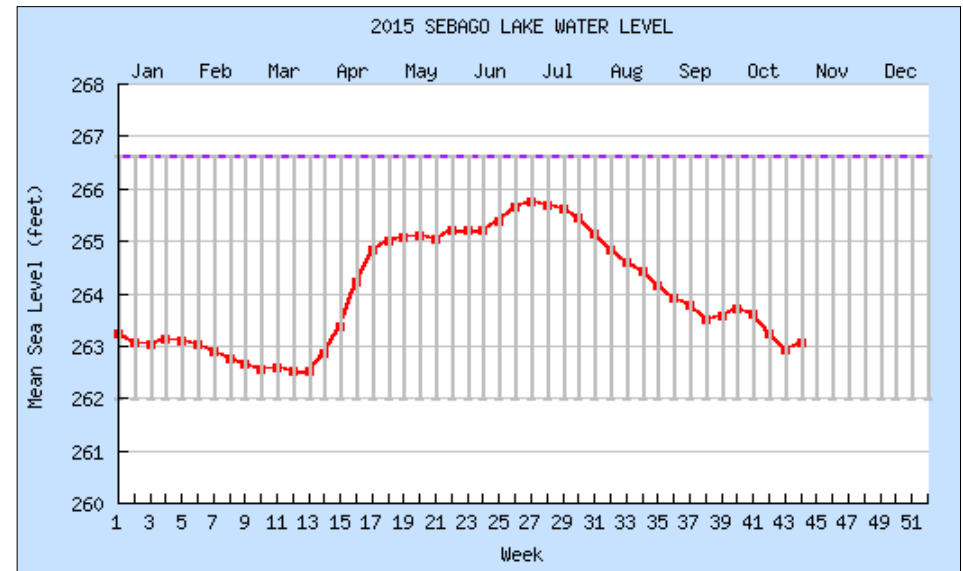
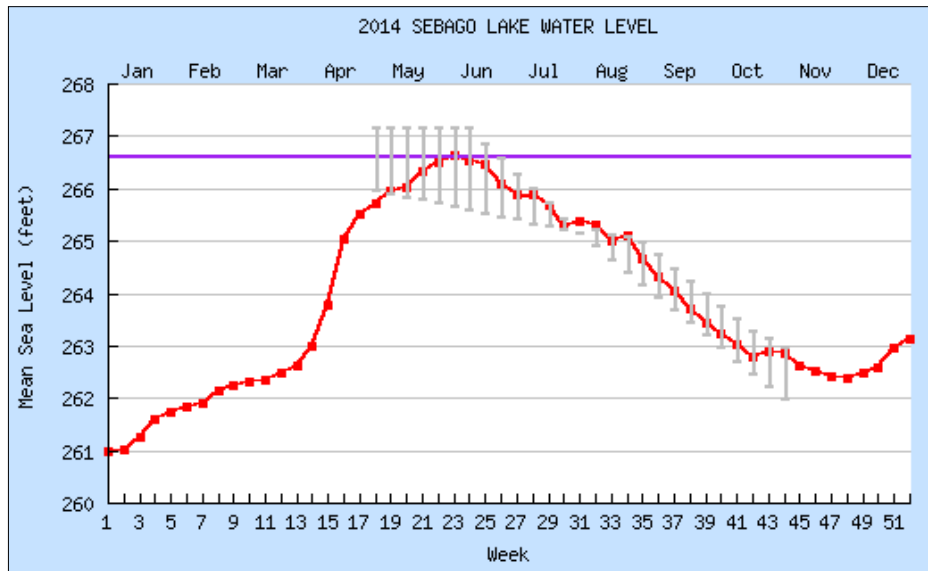
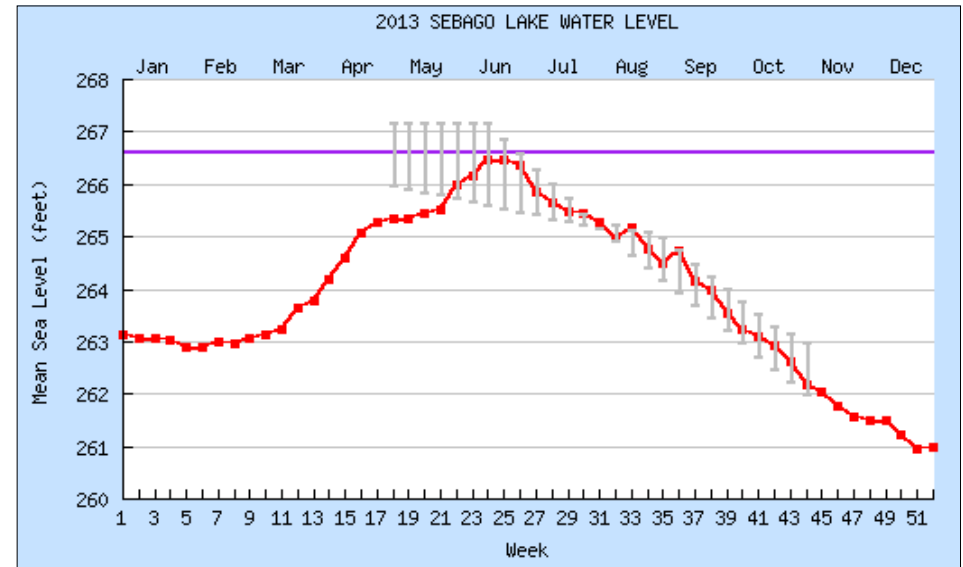
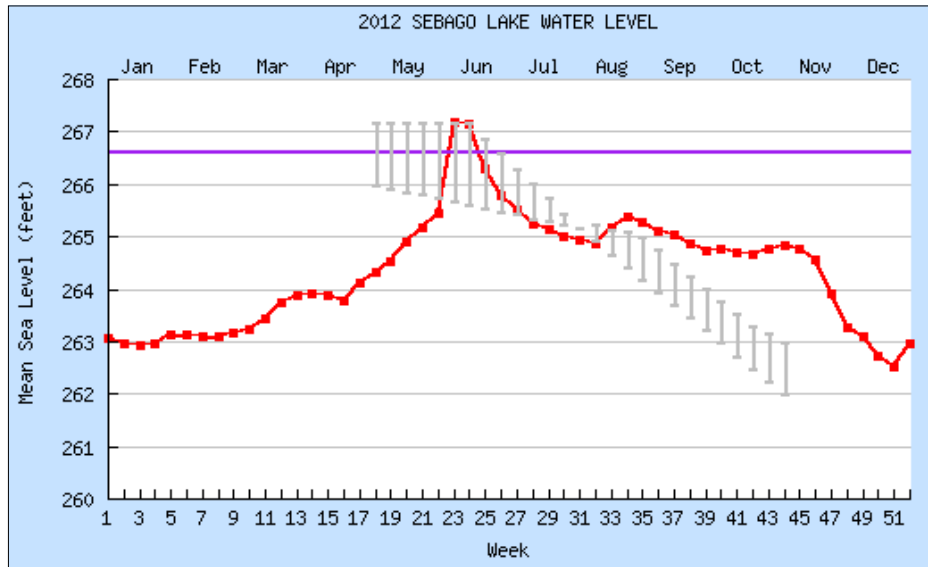


Figure 8: Please note: The red line represents the lake elevation in feet above mean sea level. The gray bars represent the acceptable water levels for each week of the year between May and November, according to the LLMP. When the red line is above or below the gray bars, SAPPI was not in compliance with the LLMP. Note that the 2015 chart has grey bars that reflect the lake level requirements of the new FERC license. As long as the lake level falls within the area indicated by the gray bars, no adjustments to outflow at the dam will be required. Note that in 2015, the lake was always within the acceptable water level range.





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