

LAKES & SWIMMING BEACHES

LAKES & SWIMMING BEACHES: MONITORING PROGRAM

BACKGROUND

In 2014, the Kitsap Public Health District collected water samples at 23 swimming beaches or other public access areas on 17 lakes in Kitsap County. Most of the public swimming beaches are located in public parks. The goal of the Lake Monitoring Program is to protect the health and safety of recreational swimmers, and to promote stewardship of lake resources through public involvement and education.

With funding provided by the Clean Water Kitsap Program¹, **623** lake water samples were collected from swimming beaches and public fishing access areas from May through September. These samples were analyzed for *Escherichia coli* (*E. coli*) bacteria. This type of bacteria is used as an indicator for the presence of human and/or animal fecal material in fresh water. Fecal material may contain bacteria and viruses which can make people sick.



Long Lake County Park

Swimming beaches and/or public fishing access areas were monitored monthly at the following lakes: Buck, Carney, Mission, Panther, Square, Symington, Tahuyeh, Tiger, Wicks, and Wye Lake. Due to a history of more frequent water quality problems and higher swimmer usage, weekly monitoring was conducted at Horseshoe, Island, Wildcat, Kitsap, and Long Lake. Samples were also collected from swimming beaches at private camp facilities on Lake Flora and Lake Helena. In addition, the Health District responded to reports of algae (cyanobacteria) blooms.

MONITORING OBJECTIVES

SWIMMING BEACH MONITORING

The objectives of the swimming beach monitoring program is intended to determine the potential health risk of swimming at a given location at a certain point in time. The results of our lake monitoring are *not* intended to establish water quality trends or identify specific pollution sources. The objectives of the swimming beach monitoring program include:

¹ Stormwater management fees from unincorporated Kitsap County fund a unique multiagency program managed by Kitsap County Public Works. Programs are implemented by Public Works Stormwater Divisions and partner agencies including; Kitsap Public Health; Kitsap Conservation District and Washington State University Extension Kitsap.

- Monitor public swimming beaches for water quality related public health indicators.
- Track and respond to reports of swimmer's itch and potentially toxic cyanobacteria blooms.

- Track and respond to reports of waterborne illness.
- Coordinate with swimming beach owners/operators regarding public health issues.
- Inform and educate swimming beach owners/operators and the public about public health and safety issues at swimming beaches.

NUTRIENT MONITORING

The objective of nutrient monitoring for lakes is to determine the aging or "eutrophication" of a lake, also known as the "trophic" state. Lake succession consists of the following steps: (1) creation of the lake basin and filling with water (e.g., through glacial action); (2) aging, or eutrophication, of the lake; (3) transformation of the lake into a wetland or marsh; and (4) filling of the wetland or marsh with sediment and growth of terrestrial vegetation (Dion, N.P., 1978). Aging, or "eutrophication," of a lake is a natural process driven by sedimentation in the lake and nutrient enrichment from numerous sources. As nutrients collect in a lake, the production of plant material increases. The stages of lake eutrophication include:

- Oligotrophic** – Very low nutrients; characterized by very clear water, with very few aquatic plants and fish.
- Mesotrophic** – Moderate amounts of nutrients; characterized by mostly clear water, with some aquatic plants and fish.
- Eutrophic** – High levels of nutrients; characterized by poor visibility in the water column, with many aquatic plants and fish. Algae blooms can be a problem in these lakes.

Cultural eutrophication is the acceleration of the lake aging process by human activities. Some human activities which can accelerate eutrophication include failing on-site sewage systems, leaking sewer lines, improper use of fertilizers, sedimentation caused by uncontrolled runoff from development activities, and improper agricultural waste management practices on farms in the lake's drainage area.

Eutrophic conditions are characterized by shallower waters and invasion of the lake by shoreline vegetation, replacement of green algae and diatoms with blue-green algae blooms, seasonal deficiencies of dissolved oxygen, and replacement of game fish by other species such as carp, suckers and catfish. These conditions often diminish the lake's ability to support beneficial uses, such as swimming and fishing.

The Health District monitors nutrient levels in some lakes to determine their current "trophic" status. To protect or restore beneficial uses to a lake, mesotrophic, meso-eutrophic and

eutrophic lakes generally require some type of intervention to correct sedimentation and nutrient enrichment problems.

In 2014, the Health District conducted trophic monitoring at Island Lake, Kitsap Lake, and Wildcat Lake.

METHODOLOGY

SWIMMING BEACHES

The U.S. Environmental Protection Agency (EPA) recommends that *E.coli* be used as the water quality indicator at freshwater swimming beaches (Ambient Water Quality Criteria for Bacteria - 1986, EPA-440/5-84-002, 1986). *E. coli* is preferred over fecal coliform bacteria because *E. coli* concentrations demonstrate the highest correlation to cases of human gastrointestinal illness. *E. coli* is also superior to fecal coliform because it is more specific to fecal sources. For example, it does not enumerate *Klebsiellae* bacteria, a possible source of error in the fecal coliform analysis.

Because of the EPA recommendation, the Health District uses *E. coli* bacteria as an indicator of human health risk in our lake swimming beach monitoring program.

Lake swimming beaches are monitored either monthly or weekly. Sampling frequencies for each beach are described in the individual lake summaries that follow. Samples are collected from a minimum of three locations within each public swimming beach area, and when applicable from two locations in public fishing accesses or other non-swimming areas. A geometric mean, or “geomean”, of the bacteria concentration is calculated from the sample results. This methodology is outlined in the Health District’s “Swimming Beach Monitoring Plan.”

The key to the program is regular monitoring for the concentration of *E.coli* bacteria – an indicator of the presence of viruses and pathogens that can make people sick.



When the samples collected during a sampling event are high, and the geomean exceeds 126 bacteria colonies per 100 ml, the area is posted with warning signs. Closed beaches are monitored regularly until the geomean is less than 126 organisms/100ml for two consecutive sampling events.

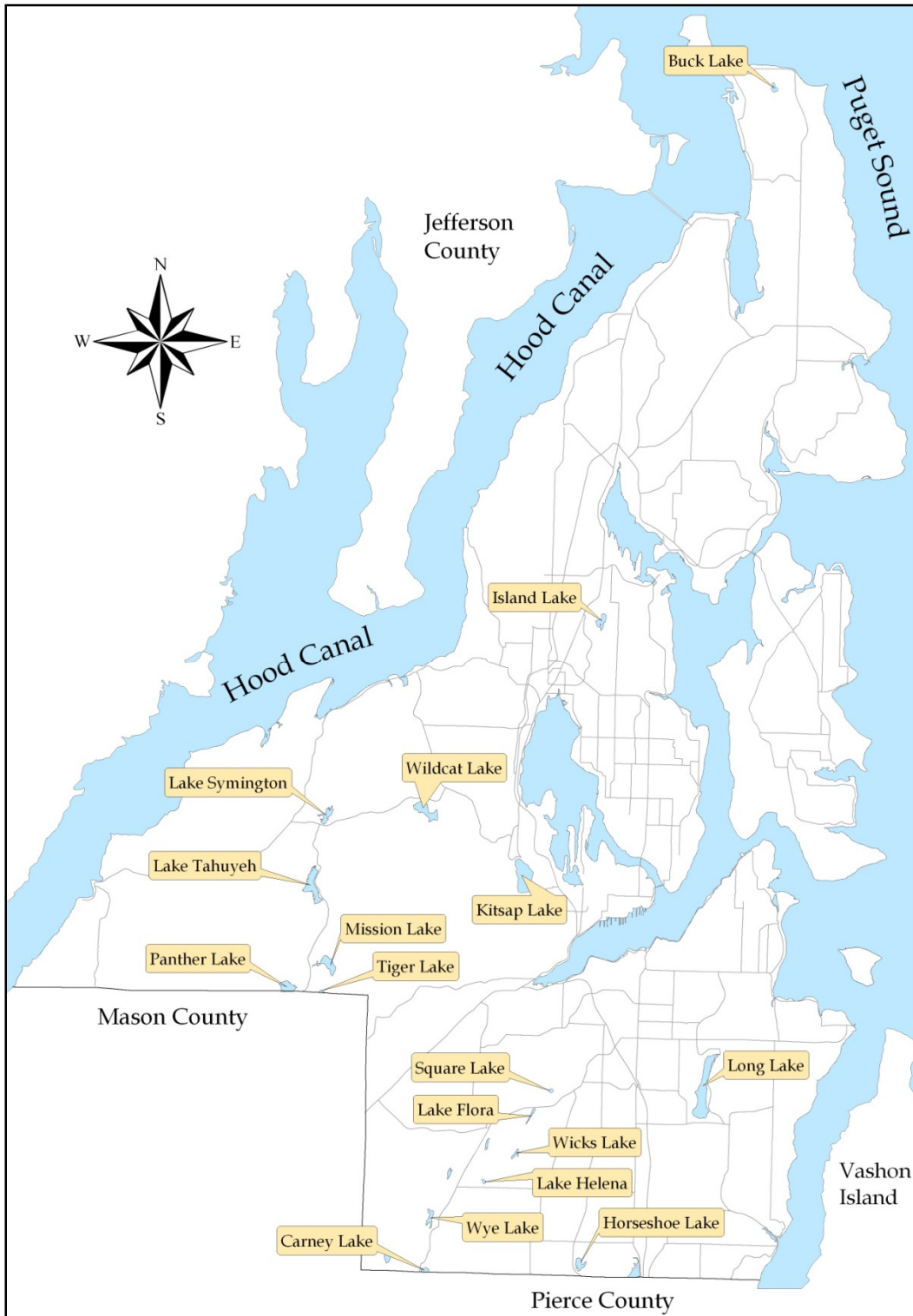
NUTRIENT OR “TROPIC” MONITORING

Trophic state monitoring generally involves monitoring lakes for nutrients (nitrogen and phosphorous), algae, and aquatic plants. Algae concentration is evaluated through estimates of transparency obtained from secchi disk measurements and analysis of lake water for the presence and concentration of chlorophyll A. Additionally, a physical survey of the type and abundance of aquatic weeds in the lake is helpful for estimating its trophic state. Detailed information about the trophic monitoring is available from the Health District’s Lake Trophic Assessment Monitoring Plan.

In addition to monitoring water quality, the Health District also responds to algae blooms, complaints of swimming-related waterborne illness, and swimmer’s itch. Table 1. summarizes the closure criteria used by the Health District when evaluating risks from bacteria concentrations, cyanobacteria, or swimmer’s itch.

TABLE 1. SUMMARY OF LAKE ACTION LEVELS AND CLOSURE CRITERIA

Parameter	Action Level	Response/Action
E. coli Bacteria	Single sample ≥ 406	Resample beach on next work day.
	Event geomean ≥ 126	Post “ Unsafe for Swimming ” warning signs, resample next work day.
	Resample event geomean < 126	Remove “Unsafe for Swimming” warning signs, no formal closure advisory.
	Resample event geomean still ≥ 126	Close beach, issue press release, revise hotline message. Resample at least weekly until reopened.
	After closure, event geomean < 126 for 2 consecutive events.	Reopen beach, change/remove warning signs, issue press release, revise hotline message.
Blue-green Algae or Cyanobacteria	Significant bloom of potentially toxic species observed in lake water.	Post “ Potentially Toxic Algae ” advisory signs. Collect algae samples to confirm species and screen for weekly toxicity, update hotline.
	Toxin present, Anatoxin-a greater than 1 ug/ml or Mycrocystin greater than 6 ug/ml.	Post “ Toxic Algae ” warning signs, issue press release, revise hotline message.
	Toxin present and animal deaths or confirmed human illness report	Post “ DANGER Toxic Algae ” warning signs, close lake to swimming, fishing, and boating, issue press release, revise hotline message.
	Visible algae bloom dissipates potentially toxic species absent and/or toxin samples negative.	Reopen beach, change/remove warning signs, issue press release, revise hotline message.
Swimmer’s Itch	Ongoing	Issue seasonal swimmer’s itch advisory for all lakes. Ensure that all lake beaches are posted with warning signs.
	Multiple reports from the same beach or lake	Post additional signage or (if the situation is severe) close the beach, address source(s), if possible, reopen when source(s) have been corrected and if E.coli sample results are within standard.
Safety Hazards	Safety hazard present that is an immediate threat to life or health	Notify the owner/operator of the hazard and close the beach until the safety hazard is corrected.
	Safety hazard present that is not an immediate threat to life or health	Notify the owner/operator verbally and in writing, follow-up inspections until hazard is corrected.
Waterborne Illness	Receive 2 or more illness reports from same beach or lake on same day	Evaluate for beach closure, issue press release, revise hotline message. Coordinate with Communicable Disease Clinic and DOH



Kitsap County Lakes with public access

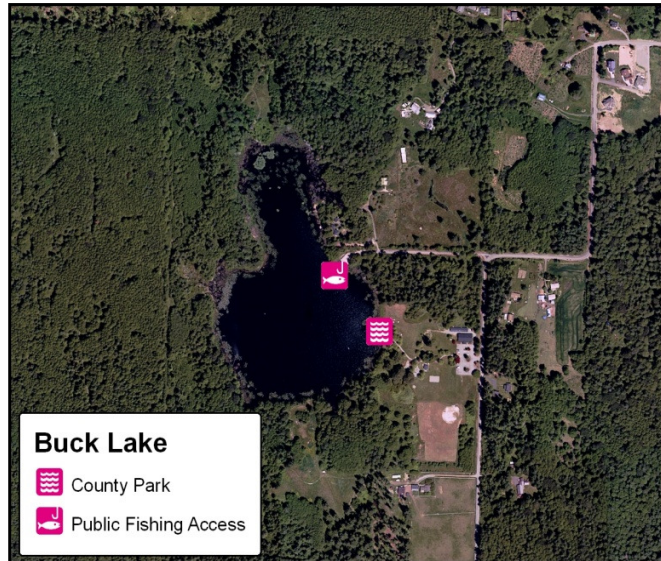
SUMMARY OF PUBLIC HEALTH ADVISORIES 2014

Lake	Swimming Beach	Health Advisory	Reason for Advisory	Duration of Advisory
Buck Lake	County Park	None		
Carney Lake	Public Fishing Access	None		
Lake Flora	Pilgrim Firs	None		
Lake Helena	Camp Niwana	None		
Horseshoe Lake	County Park	Closed	Norovirus Illness Outbreak	7/14/2014 through 7/19/2014
Horseshoe Lake	Miracle Ranch	None		
Island Lake	County Park	None		
Island Lake	Crista Camp	None		
Kitsap Lake	Kitsap Lake Park	Caution	Potentially Toxic Algae Bloom	6/11/2014 through 9/30/2014
Long Lake	County Park	Closed	Toxic Algae Bloom	8/29/2014 through 9/16/2014
		Caution	Potentially Toxic Algae Bloom	8/27/2014 through 8/29/2014 and 9/16/2014 through 9/30/2014
Mission Lake	Public Fishing Access	None		
Panther Lake	Public Fishing Access	None		
Square Lake	State Park	None		
Lake Symington	Spillway Park	None		
Lake Symington	Division 5 Park	None		
Lake Tahuya	Community Park	None		
Tiger Lake	Public Fishing Access	None		
Wicks Lake	County Park	None		
Wildcat Lake	County Park	None		
Wildcat Lake	Lutherhaven North & South	None		
Wye Lake	Shirey Park	None		

INDIVIDUAL LAKE SUMMARIES

BUCK LAKE

Buck Lake is located at the northern tip of the Kitsap Peninsula, near Hansville, in the Foulweather Bluff/Appletree Cove watershed. The Health District monitored the public swimming beach at Buck Lake County Park monthly between May and September. Monitoring station locations are shown in Figure 12-2, and sample results are summarized in Table 12-2.



Water quality at Buck Lake County Park met the *E. coli* standard throughout the 2014 season. No complaints of swimmer's itch from Buck Lake were documented in 2014.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Buck Lake is "meso-eutrophic." This classification is characterized by mostly clear water with moderately high plant and animal production.

Buck Lake sampling station locations.

BUCK LAKE 2014

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Buck Lake County Park	12	1 - 82	4.8	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-3 for a more detailed explanation.

ISLAND LAKE

Island Lake is located within the Dyes Inlet watershed in central Kitsap County. The Health District monitored two stations on Island Lake: the swimming beaches at Island Lake County Park and Crista Camp (a private camp). The beaches at Island Lake were monitored weekly between May and September. Monitoring station locations are shown in Figure 12-3, and results summarized in Table 12-3.



The beaches at Island Lake met the *E. coli* standard throughout the 2014 season. One complaint of swimmer's itch were reported from the Island Lake County Park in 2014. The organism that causes swimmer's itch has been prevalent at Island Lake's swimming beaches in past years.

The beaches at Island Lake met the *E. coli* standard throughout the 2014 season. One complaint of swimmer's itch were reported from the Island Lake County Park in 2014. The organism that causes swimmer's itch has been prevalent at Island Lake's swimming beaches in past years.

Nutrient Summary

The most recent data for this lake, combined with recent observations, indicates the trophic state of Island Lake is "mesotrophic." This indicates a moderate amount of nutrients; characterized by mostly clear water, with some aquatic plants and fish.

ISLAND LAKE 2014

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Island Lake County Park	68	1 – 1119.9	14.3	0
Crista Camp	45	1 – 21.8	4	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms.

KITSAP LAKE

Kitsap Lake is located within the Dyes Inlet watershed in central Kitsap County. In 2014, the Health District monitored the swimming beach at the City of Bremerton's Kitsap Lake Park.



The beach at Kitsap Lake was monitored weekly between May and July. Bacteria levels at Kitsap Lake Park met the *E. coli* standard throughout the 2014 season. The Kitsap Public Health District posted "Potentially Toxic Algae" advisory signs periodically through summer months when potentially toxic species were observed in lake water with the first posting occurring on August 28, 2014. This advisory was in effect until December 15, 2014.

Nutrient Summary

The most recent data for this lake indicates it is "eutrophic."

This classification is characterized by poor visibility in the water column, high nutrients, and high plant and animal production. Cyanobacteria blooms can be a problem in these lakes. This process can be accelerated by human activities affecting the lake.

KITSAP LAKE 2014

Sampling Location	Number of Samples	<i>E. coli</i> Range	<i>E. coli</i> Geomean ¹	Swimming Beach Health Advisories ²
Kitsap Lake Park	34	1 – 2419.6	5.4	Potentially toxic algae bloom from 6/11/14 to 9/30/14
Camp McKean	33	1 – 74.3	2.7	0

¹ Reported as a geometric mean for the entire sampling season.

² The Health District issues health advisories when there is an increased risk of illness from bacteria or potentially toxic algae blooms. See page 12-3 for a more detailed explanation.