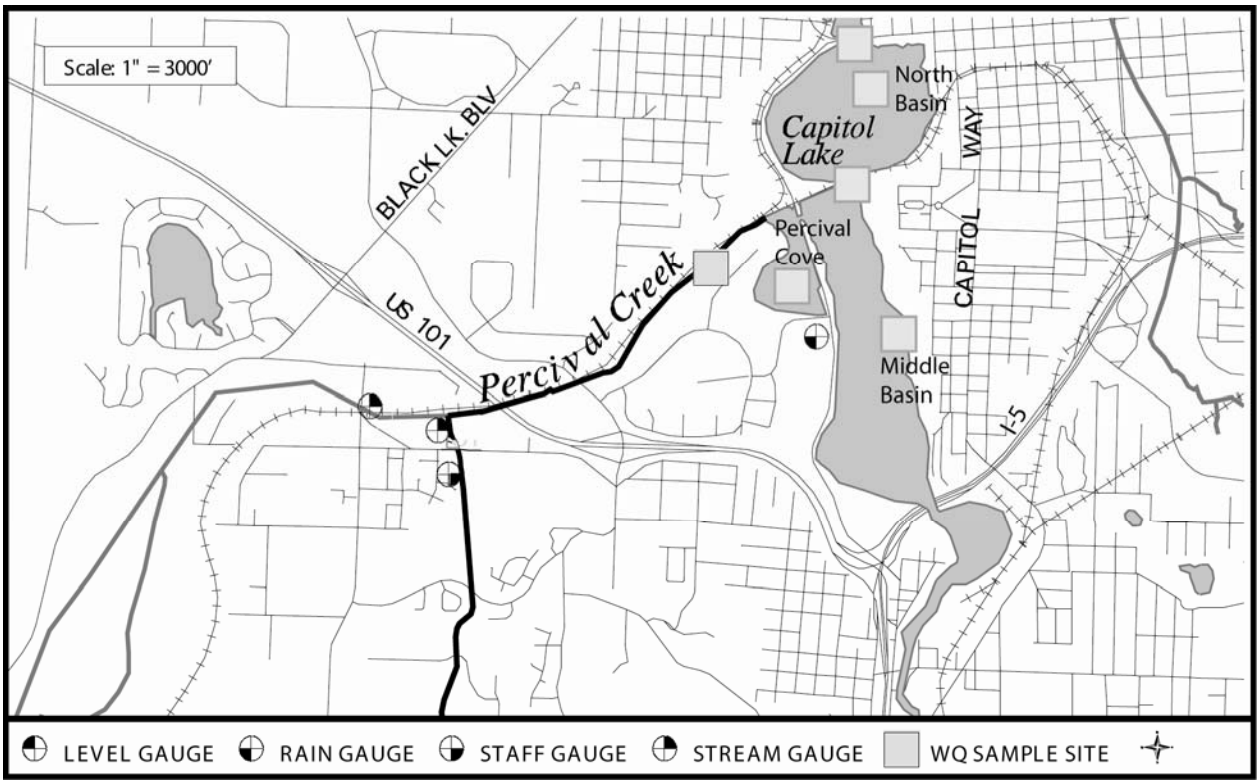
Capitol Lake 2011



PART OF Budd Inlet **WATERSHED**

LENGTH OF LAKE: 1.6 miles

SHORELINE LENGTH: 5.3 miles

LAKE SIZE: 270 acres

BASIN SIZE: 185 square miles

MEAN DEPTH: 9 feet

MAXIMUM DEPTH: 20 feet

VOLUME: 2400 acre-feet

PRIMARY LAND USES:

The Deschutes River/Capitol Lake basin includes commercial forestry in the upper basin and agriculture and rural residential in the middle of the watershed. Urban land uses in the lower watershed include portions of the Cities of Tumwater and Olympia.

PRIMARY LAKE USES:

Shoreline trails are used by walkers, joggers, and bird watchers. The lake is closed to boating and fishing to prevent the spread of an invasive species, New Zealand Mudsnail.

PUBLIC ACCESS:

All of the northern basin and much of the western sides of the middle and southern basins are publicly owned. There are four parks along the lake, including Marathon Park, Tumwater Historical Park, Heritage Park, and the Capitol Lake Interpretive Center. There is a trail system along much of the western shoreline and around the north basin.

The public boat launch at Tumwater Historical Park on the south side of the Interstate 5 bridge is currently closed to help prevent the spread of an invasive snail species, New Zealand Mudsnail.

GENERAL TOPOGRAPHY:

The approximate altitude of the lake is 0 feet. Capitol Lake now covers much of the former saltwater estuary that was at the mouth of the Deschutes River. In 1951 a tide gate was constructed at 5th Avenue, creating a freshwater lake and preventing saltwater from flowing into the lake under all but extreme high tide conditions. The lake is divided into three basins, constricted by fill at the Interstate 5 overpass and the railroad trestle near Marathon Park.

GENERAL WATER QUALITY:
(Excellent, Good, Fair, Poor)
Poor: The lake is listed on the state's 303(d) list of water quality impaired water bodies for total phosphorus and fecal coliform. Sediment deposition in the lake from the Deschutes River, Percival Creek, shoreline erosion, and landslides has been an on-going issue since the lake was created. Excessive aquatic plant and algae growth in the summer severely impedes navigation on the lake. Control is on-going for an infestation of the noxious aquatic plant, Eurasian water milfoil. In 2009 another invasive species, the New Zealand mudsnail, was discovered in the lake. Efforts are underway to control the spread of the mudsnail.

OTHER AVAILABLE DATA:

Thurston County Environmental Health Division, (360) 867-2626, (historical water quality data) or www.co.thurston.wa.us/health/ehswat/swater.htm

GENERAL DISCUSSION:

Background
The area of Capitol Lake was formerly an estuary of Budd Inlet. The lake was formed by the construction of a tide gate in 1951, which impounded the Deschutes River. The tide gate was constructed to create a reflection pond for the state capitol building. The resulting body of water looks like a lake, however the exchange of water into and out of the lake occurs fairly quickly compared to most lakes. During high winter flows in the Deschutes River the water exchange in the lake can be as fast as a few hours. During the summer low-flow period the exchange rate is much slower, and can be as slow as 9 days.

Capitol Lake has several water quality problems. As an impoundment of the Deschutes River, Capitol Lake shares some of the river's characteristics, such as elevated nutrient levels, and high turbidity during winter storms. The lake is gradually filling with sediments transported into it by the Deschutes River and Percival Creek and other smaller sources. The wide shallow basins result in high surface water temperatures and allow light to reach the bottom of most of the lake. This provides excellent habitat for aquatic plants and algae, which impair recreational uses of the lake and further contributes to water quality problems. Until 1985, a swimming area was operated by the City of Olympia at the north end of the lake. However, poor water clarity and high fecal coliform bacteria levels forced the closure of the swimming area. Water circulation into and out of the swim area was poor, and likely contributed to its chronic water quality problems. There are numerous stormwater discharges into the lake along the shoreline in all three basins.

Likely sources of bacteria and nutrient pollution to the lake include: agricultural activities along the Deschutes River and its tributaries, septic systems, resident waterfowl on the lake, highway and

urban stormwater runoff, accidental spills, illicit sewage discharges, and other nonpoint pollution sources.

To reduce the water quality impact on Percival Creek from stormwater discharges, the City of Olympia constructed a regional stormwater detention/wetland system along Black Lake Ditch in the early 1990's. In 2003, the City of Olympia initiated an illicit discharge detection and elimination program to identify and eliminate sewer connections to the city storm sewer systems. Since the program inception several illicit connections have been found and eliminated. The City of Tumwater currently has plans to build regional stormwater facilities to address discharges into both Percival Creek and the Deschutes River. These facilities are in the design phase.

Capitol Lake is the responsibility of the Washington Department of Enterprise Services (formerly General Administration). Management of the lake has been guided by a 10-year Capitol Lake Adaptive Management Plan adopted in 2003. In September 2009, the Capitol Lake Steering Committee delivered a majority recommendation to the Director of Enterprise Services to remove the tidegate and restore the Deschutes River estuary in place of the existing lake. The community is divided regarding the estuary recommendation, and some residents support maintaining the lake. In 2010, the decision regarding restoration of the Deschutes estuary was suspended.

2011 Ambient Monitoring Program

In 2011 the sampling locations for ambient monitoring program were two mid-lake sites in the north and middle basins. The sampling program was to include monthly sampling at those two locations, May through October. However, an equipment malfunction prevented completion of sampling in May. And in July the lake level was raised to accommodate maintenance work which prevented access to the north basin site for sampling. Sampling is done with the assistance of the Department of Enterprise Services staff, using a boat that is dedicated to Capitol Lake. Procedures are used when sampling to prevent the spread of the New Zealand mudsnail.

Sample parameters included temperature, pH, dissolved oxygen, specific conductivity, water clarity, total phosphorus, total nitrogen, nitrate, ammonia, chlorophyll *a*, fecal coliform bacteria, and algae identification. Nutrient, chlorophyll, and algae samples were collected at a depth of one-meter. Nitrate and ammonia are included in the nutrient analyses to further document the affect the lake has on nutrient utilization as the river water passes through the lake. The water quality data is located at the end of this narrative.

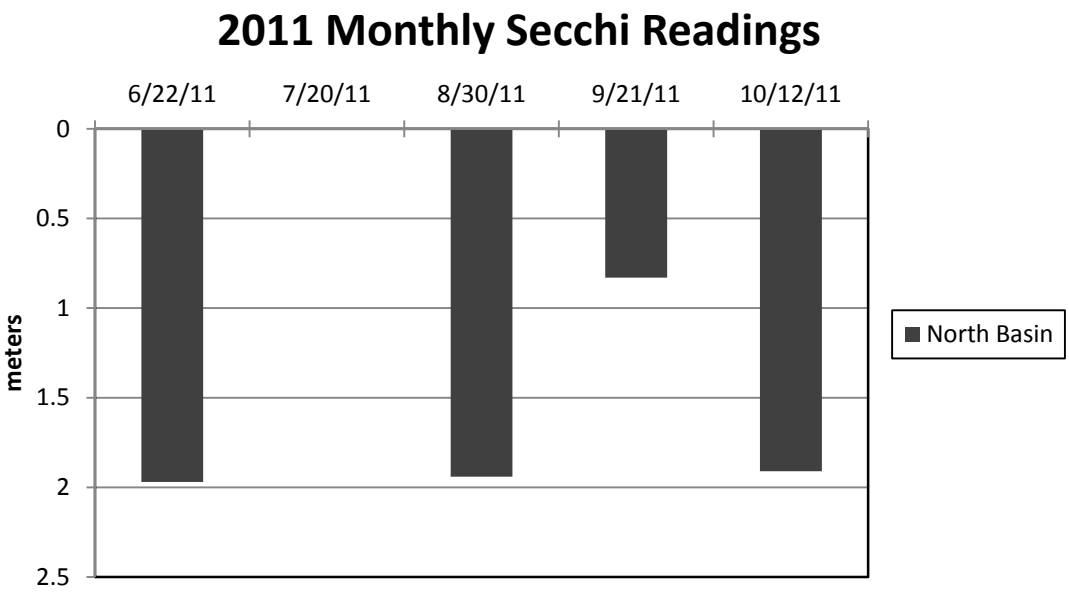
Field Parameters

Profile graphs of the field measurements are located on pages 14 and 15. Capitol Lake does not thermally stratify as do most Thurston County lakes due to its shallow depth and riverine influence. In mid-summer, the temperature at the bottom, in both basins, tended to be just three to four degrees cooler than at the surface. High conductivity (saline water) was sometimes measured near the bottom in the north basin. This was the result of marine water from Budd Inlet flowing over the fish ladder and into the lake during tides higher than 14 feet, where the heavier saltwater settles in the deepest part of the lake.

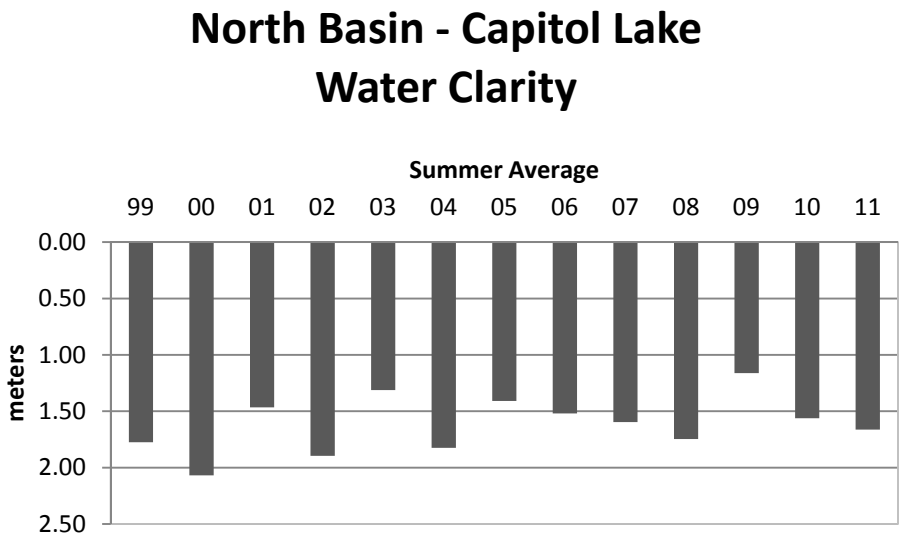
Capitol Lake typically has high day time dissolved oxygen levels during late summer that are associated with peak algae and aquatic plant growth. In 2011 highest dissolved oxygen levels were measured in the north basin in September with a concentration of 16.25 mg/L near the surface at 2:30 PM. On that day the chlorophyll *a* concentration was the highest measured for the season, 33 µg/L, which indicates that algae was influencing the dissolved oxygen levels. Rooted aquatic plants were also likely contributing to the high dissolved oxygen levels. It is during this time that dissolved oxygen sags, or deficits, would be expected to occur during the nighttime hours and be at the lowest just before sunrise. However, there was no 24-hour monitoring conducted in 2011.

Water Clarity

The graph below shows the 2011 monthly water clarity measurements in the north basin. The water clarity standard that is applied to bathing beaches is four (4) feet or greater. The poorest water clarity this season was measured in September at 0.83 meters (or 2.7 feet). The highest water clarity was measured in June at 1.97 meters (or 6.5 feet).



The season average clarity in the north basin in 2011 was 1.66 meters (5.4 feet). On the next page is a graph of the average summer water clarity in the north basin for the past thirteen years. Generally the averages were calculated using four to six monthly measurements collected within the May through October period. The exception is 1999, where the only data collected was in September and October. The graph shows that the yearly average water clarity has varied by up to 0.9 meters, from 2.1 meters in 2000 to 1.2 meters in 2009.



Fecal Coliform Bacteria

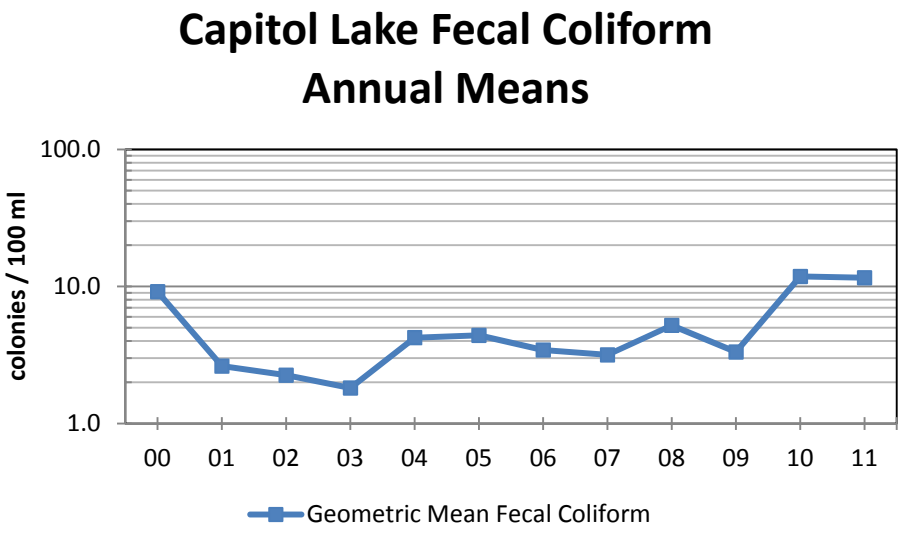
Fecal coliform bacteria samples are collected as part of the monitoring program because of the historic use of the lake for water contact recreation. Additionally, the lake is listed on the Washington Department of Ecology 303(d) list of impaired water bodies for fecal coliform bacteria standard violations. The results from this year's bacteria sampling are shown in the table below.

Capitol Lake Fecal Coliform Bacteria Sampling Results

Date	North Basin	Middle Basin
6/22/11	20	30
7/20/11	No sample	15
8/30/11	<5	5
9/21/11	<5	5
10/12/11	60	163

The state water quality standard for primary contact recreation is a geometric mean of 50 fecal coliform colonies per 100 ml with not more than ten (10) percent of the samples exceeding 100. The county policy regarding closure of a bathing beach sets the fecal coliform standard at a geometric mean of 200 colonies per 100 ml. All sample results in 2011 were below the beach closure threshold of 200. The geometric mean for the year was 11, which was within the part one of the state fecal coliform standard of 50. However, part two of the fecal coliform standard was not met because one of the nine samples collected had a result greater than 100 colonies per 100 ml, so 11 percent of the samples collected were greater than 100.

Individual sample results from the past twelve years are included in a table on pages 12 and 13. The graph below shows the geometric mean of all the fecal coliform results collected at both the north and middle basin sites for each year since 2000. The results for the last two years appear to be slightly higher than previous years, but still within the standard of 50 colonies per 100 ml.



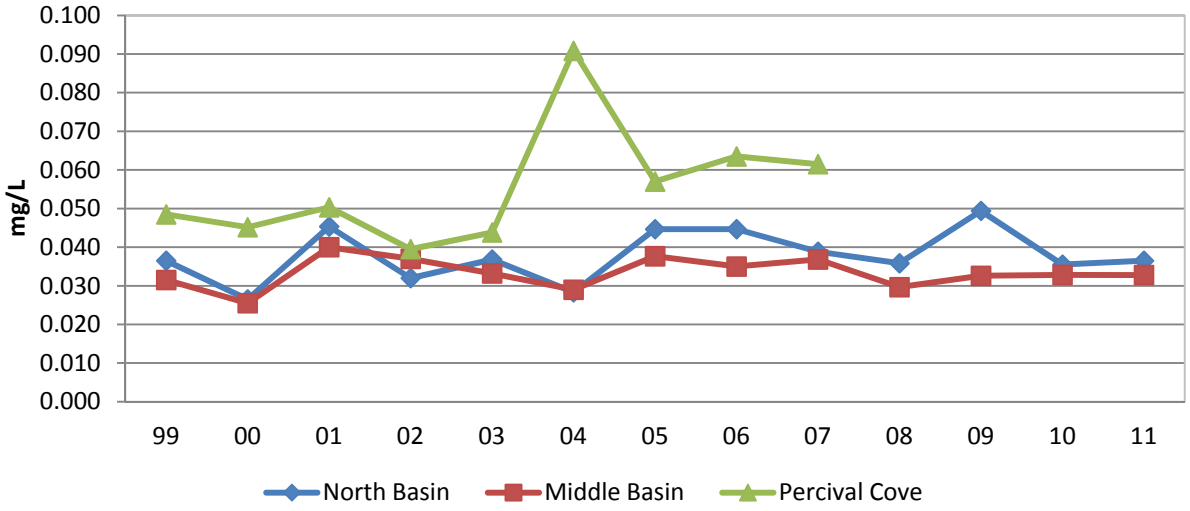
Nutrients

Generally, lakes in the Puget Sound region with summer average surface total phosphorus concentrations greater than 0.030 mg/l experience undesirable algae growth which interferes with recreational uses of the lake (USGS Water Supply Paper 2240). The action level established in WAC 173-201A, "Water Quality Standards for Surface Water of the State of Washington" is 0.020 mg/l.

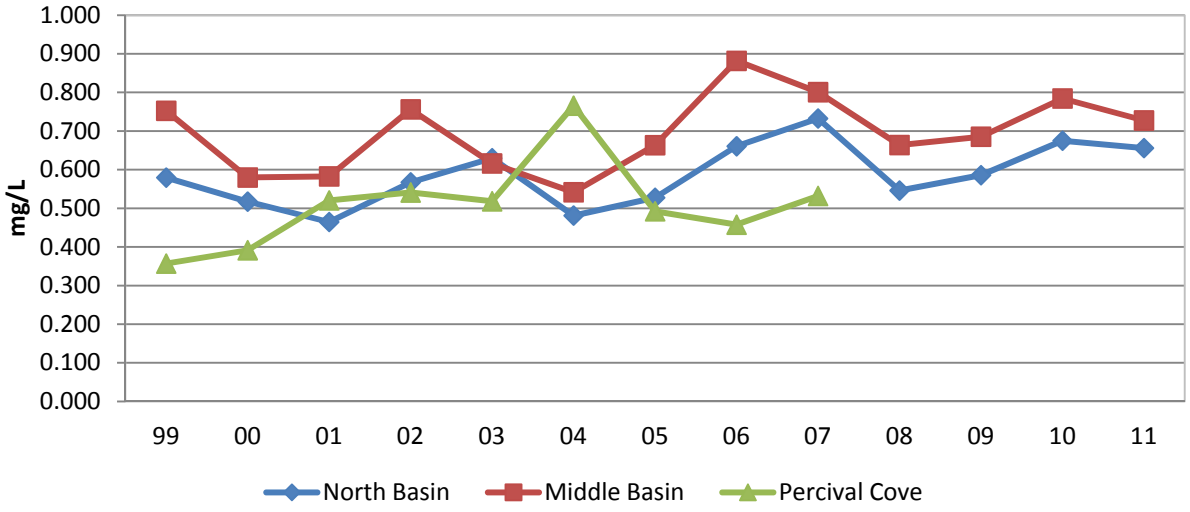
The average 2011 surface total phosphorus (TP) concentration in the north basin was 0.037 milligrams per liter (mg/l), and the middle basin's average was 0.033 mg/l. Every individual sample in 2011 had a total phosphorus concentration greater than the 0.020 mg/L state action level. A graph of the annual average total phosphorus concentrations for the north and middle basins and Percival Cove (up to year 2007) since 1999 is shown on page 7. Generally, the phosphorus concentration in the north and middle basins were similar. Percival Cove had notably higher phosphorus than the main lake basins.

Annual average total nitrogen concentrations for both basins are also graphed on page 7. In 2011, the north basin average total nitrogen concentration was 0.656 milligrams per liter (mg/l) and the middle basin concentration was 0.727 milligrams per liter (mg/l). The graph shows that the middle basin consistently has higher nitrogen concentrations than the north basin. The total nitrogen to total phosphorus ratio in the both basins indicate that the lake is phosphorus limited during the summer.

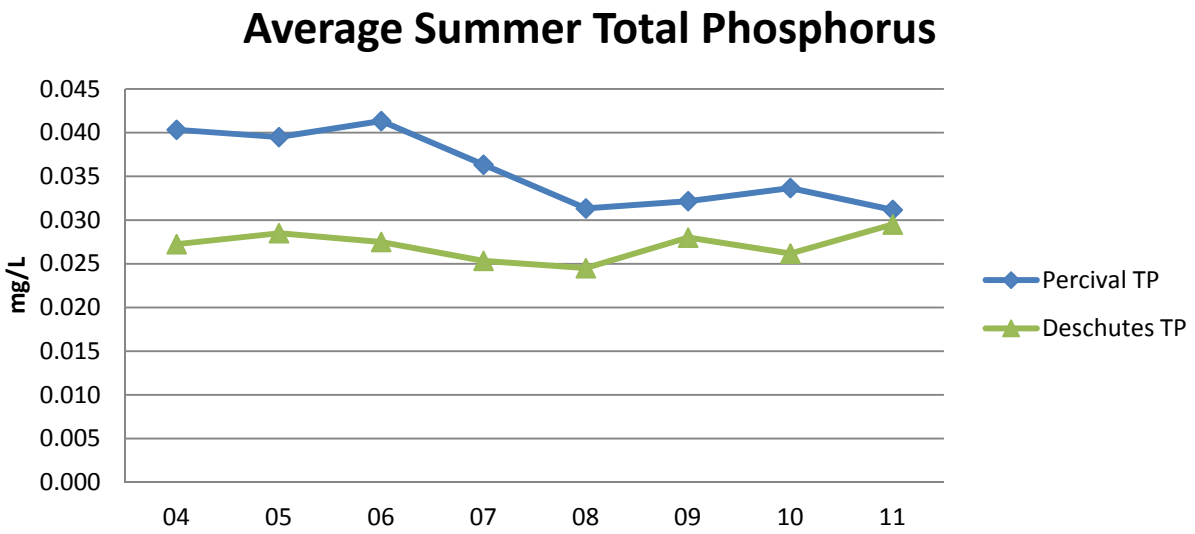
Capitol Lake Total Phosphorus
Average Annual Surface Concentrations



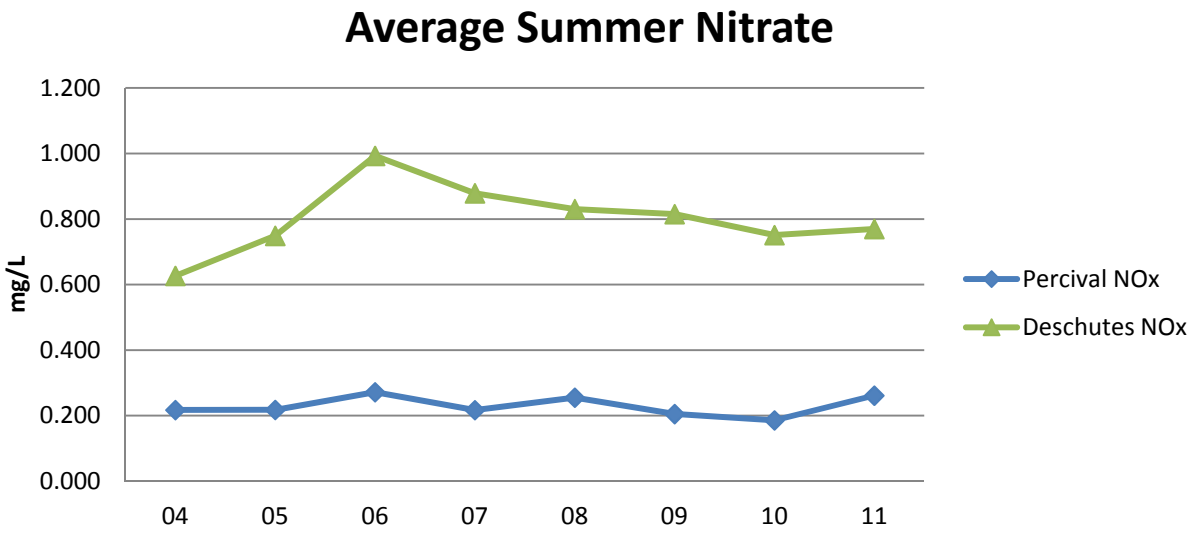
Capitol Lake Total Nitrogen
Average Annual Surface Concentrations



The Deschutes River and Percival Creek are the two primary tributaries to the lake. The average summer total phosphorus and nitrate concentrations from 2004 to 2011 for the Deschutes River and Percival Creek are graphed below. Percival Creek has higher phosphorus concentrations than the river, and the range is similar to the average concentrations measured in the lake.



The Deschutes River has higher nitrate-nitrogen concentrations than Percival Creek. The average ranged from 0.63 mg/l in 2004 to 0.99 mg/l in 2006. The average **total** nitrogen concentrations in the middle basin of the lake for the 2004 to 2011 time period followed a very similar pattern as the river, although at slightly lower levels. The range of the average **total** nitrogen in the middle basin for that same time period was 0.48 mg/l in 2004 and 0.73 mg/l in 2006.

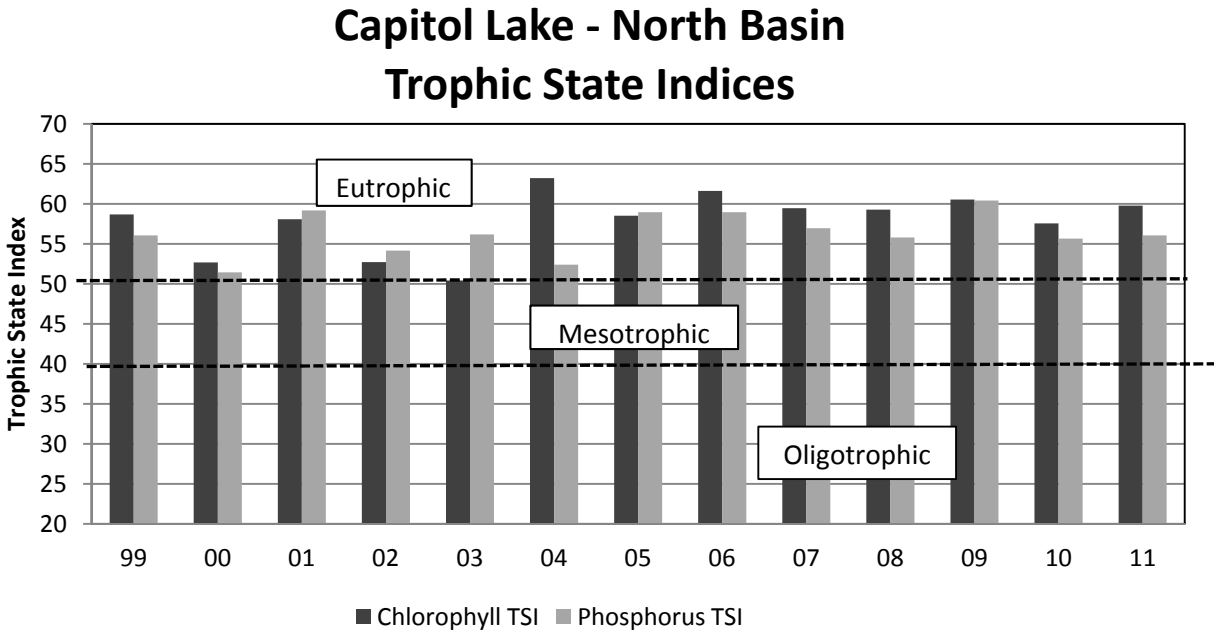


Trophic State Indices

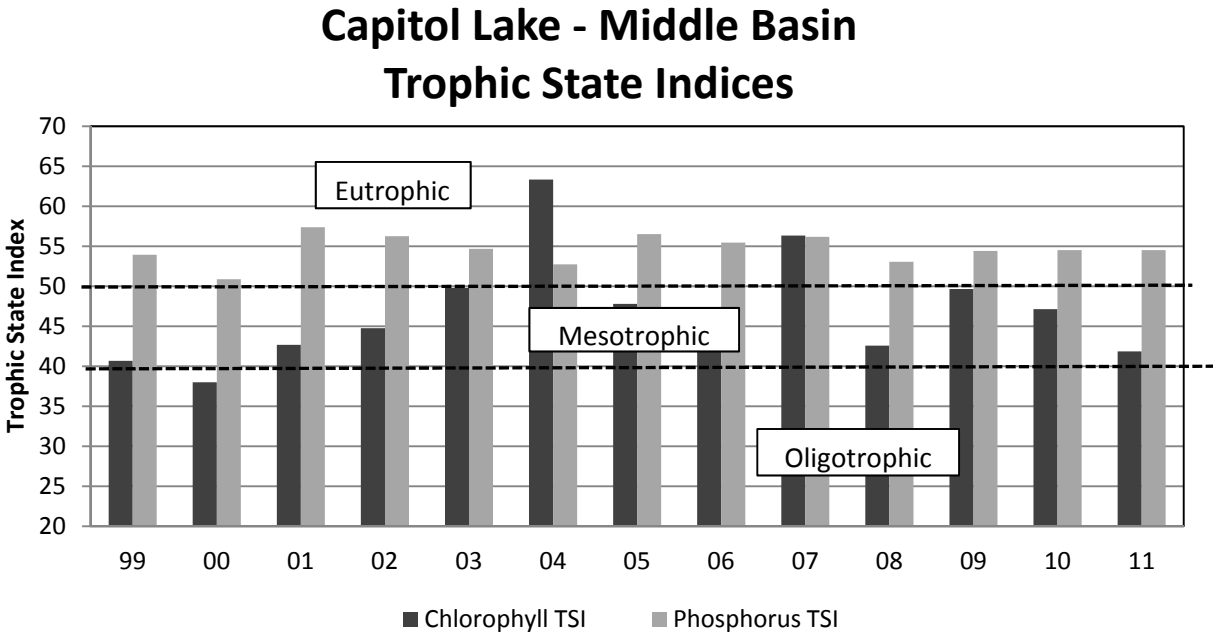
The Carlson trophic state indices (TSI), are used to express the degree of productivity (algae, etc.) of a lake. Average summer total phosphorus and chlorophyll *a* concentrations and secchi disk transparency are each used to calculate TSIs for a lake. TSIs of 0 to 40 indicate an oligotrophic, or low productivity, lake. TSIs of 41 to 50 indicate a mesotrophic, or moderately productive lake.

TSIs of greater than 50 indicate a eutrophic, or highly productive lake. Due to the shallow condition of Capitol Lake and the dense rooted aquatic plant growth that occurs, the secchi disk often either reaches the bottom of the lake or is obscured by plants, especially in the middle basin. Therefore, secchi TSIs are not a good indicator of trophic status and were not calculated for either basin.

The north basin's 2011 TSIs for chlorophyll *a* and total phosphorus were 60 and 56, respectively. The middle basin had TSI values of 42 and 55 for chlorophyll *a* and total phosphorus, respectively. The TSIs from 1999 to 2011 for the north and middle basins are shown on the graphs below.



Note: '99 indices calculated from Sept and Oct data only



Note: '99 indices calculated from Sept and Oct data only

The TSIs show that both basins are nutrient-rich with phosphorus TSIs in the eutrophic range. The chlorophyll TSI for the north basin is also consistently in the eutrophic range indicating a highly productive system. The cholorophylll TSI for the middle basin TSIs is much lower and consistently within the mesotrophic range, indicating less algae production. This is an effect of the riverine-like characteristics of the lake. The middle basin, being upstream of the north basin and closer to in-coming river water, has a less developed algae community than farther downstream in the lake.

The 2004 TSIs were artificially high as a result of the effects of an herbicide treatment in the lake for the control of the invasive aquatic plant, Eurasian water milfoil.

Algae

In most nutrient-rich Thurston County lakes, blue-green algae tend to be the dominant algae group and the ones associated with "algae blooms". The algae composition in Capitol Lake is different, in that it tends to have more diatom species present than most other eutrophic lakes in this county. This is likely due to the lake's location at the downstream end of the Deschutes River system. In G.W. Prescott's, "The Algae: A Review", it says that water current is a major factor in the algae composition of flowing water environments. The organisms must be able to physically survive the rigors of current, be able to assimilate nutrients readily from flowing water, and be able to reproduce under those conditions. The diatom group is a diverse group, and many of the diatom species have characteristics that allow them to inhabitat flowing water environments. The blue-green algae, typical of a eutrophic lake, appear more often in the north basin than the middle basin, and during late summer and early fall.

The 2011 algae data is included at the end of this report. It is a list of those genus present in the sample, in alphabetical order by category. The order listed does not reflect dominance.

Major Issues:

- A 10-year plan (for 2003 to 2013) for adaptively managing Capitol Lake was developed by the Washington Department of Enterprise Services and a multi-agency steering committee. The goal of the plan is to achieve measurable improvements in flood control, water quality, sediment management and infrastructure improvements. The plan identifies fourteen management objectives, which have been adopted by the State Capitol Committee and are being implemented by the Washington State Department of Enterprise Services and the other participating agencies.

- In 2009 the Capitol Lake steering committee made a recommendation to the Washington Department of Enterprise Services to return the lake to a naturally functioning estuary after reviewing the results of several scientific studies conducted to determine the feasibility of estuary restoration. However, in May 2010, Enterprise Services, at the directive of the Legislature, suspended the Capitol Lake adaptive management planning process, due to budget limitations.

- The Washington State Department of Ecology is conducting a total maximum daily load study in the Deschutes River/Budd Inlet system. This includes modeling the effects of the lake on Budd Inlet. Discharge limits for pollution sources will also be established. The draft technical report was released in October 2008. A stakeholder committee was convened in 2009 and has begun development of a water quality cleanup plan. The plan is anticipated to be completed in January 2013.

- Some of the past and present Capitol Lake management issues include:
  Sediment deposition and dredging
  Poor water quality
  Controlling the population of resident Canada and domestic geese
  Accidental sewage and chemical spills
  Excessive aquatic plant and algae growth
  Invasive species such as purple loosestrife, Eurasian water milfoil**,** New Zealand mudsnail
  Flooding and lake shoreline erosion
  Chinook salmon hatching and rearing operation
  Stormwater discharges

- In 2001 Eurasian water milfoil, a non-native, invasive aquatic plant, was discovered in the lake. In summer 2004, the herbicide, triclopyr, was applied to the lake to control the milfoil infestation. In 2005, some surviving milfoil plants were discovered in the south basin and in the wetland near the Interpretive Center. Since then hand pulling and other alternative means of control are being used to help control the plant's spread.

- In 2009 the invasive species, New Zealand mudsnail was discovered in the lake. The Department of Enterprise Services has restricted lake access to prevent the spread of the snail to other water bodies. They are trying various control techniques including lake draw down during freezing weather conditions.

Funding Sources:

Funds for water quality monitoring in 2011 were provided by the State of Washington Department of Enterprise Services (formerly the Department of General Administration)

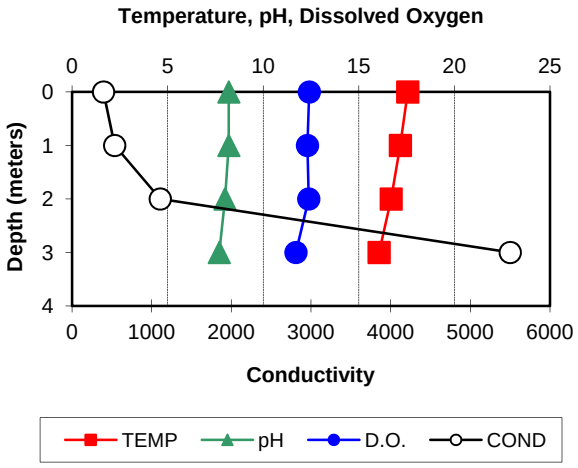
Capitol Lake Fecal Coliform Bacteria Sample Results

Date	North Basin	Middle Basin	Percival Cove
6/21/00	5	5	10
7/19/00	5	3	10
8/23/00	<5	5	<5
9/21/00	25	20	5
10/25/00	40	35	5
5/16/01	35	45	10
6/20/01	<5	<5	5
7/17/01	5	<5	<5
8/15/01	<5	<5	<5
9/20/01	10	<5	5
10/19/01	<5	<5	10
5/20/02	<5	5	<5
6/17/02	<5	13	5
8/28/02	<5	<5	–
9/26/02	<5	7	–
6/19/03	–	--	5
7/17/03	<5	<5	5
8/19/03	<5	5	<5
9/24/03	5	<5	5
5/25/04	8	<5	<5
6/14/04	6	11.5	5
7/13/04	2	3	5
8/18/04	1	1	<5
9/29/04	4.5	9	10
10/13/04	<5	15	5
5/18/05	50	45	60
6/22/05	5	38	<5
7/20/05	<5	<5	<5
8/17/05	<5	5	<5
9/14/05	<5	<5	<5
10/18/05	<5	15	<5
5/24-25/06	10	105	40
6/21-22/06	5	<5	<5
7/26/06	<5	<5	<5
8/16/06	<5	<5	5
9/20/06	5	10	10
10/11/06	<5	5	<5
5/23/07	<5	<5	15
6/18/07	<5	20	10
9/12/07	<5	<5	--
9/26/07	5	<5	--
10/17/07	15	50	--

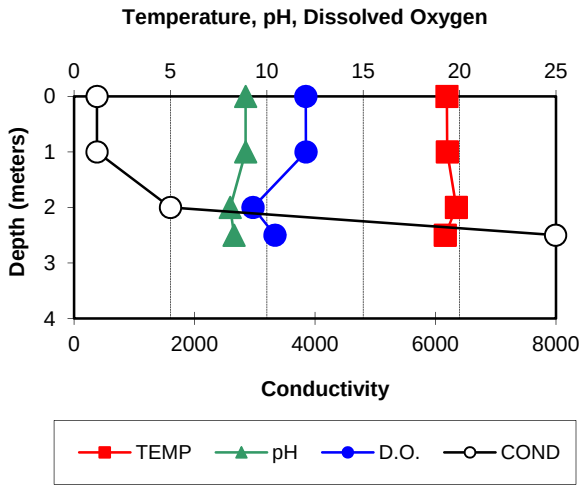
Date	North Basin	Middle Basin	Percival Cove
5/21/08	50	25	--
6/16/08	5	5	--
7/15/08	<5	5	--
8/12/08	20	<5	--
9/17/08	<5	<5	--
10/15/08	5	10	--
5/26/09	10	20	--
6/24/09	<5	<5	--
8/19/09	<5	5	--
9/14/09	<5	10	--
10/14/09	<5	10	--
5/27/10	45	60	--
6/23/10	45	10	--
7/22/10	10	45	--
8/25/10	<5	80	--
9/22/10	--	10	--
10/21/10	<5	<5	--
6/22/11	20	30	--
7/20/11	--	15	--
8/30/11	<5	5	--
9/21/11	<5	5	--
10/12/11	60	163	--
Mean (GMV)	3	6	4
# of records	61	63	37

CAPITOL LAKE - NORTH BASIN

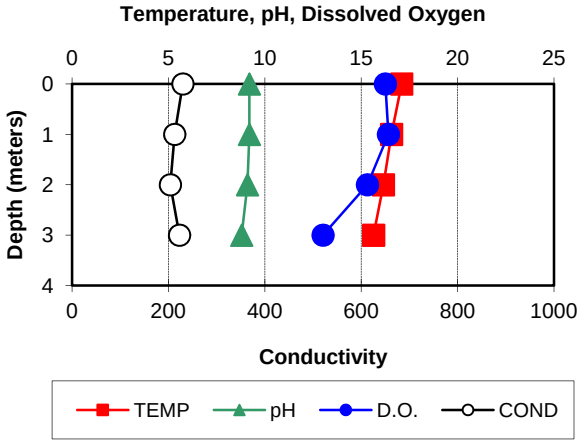
June 22, 2011



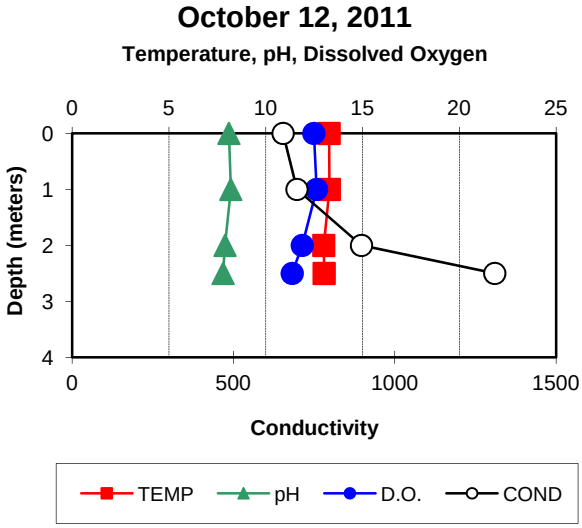
August 30, 2011



September 21, 2011

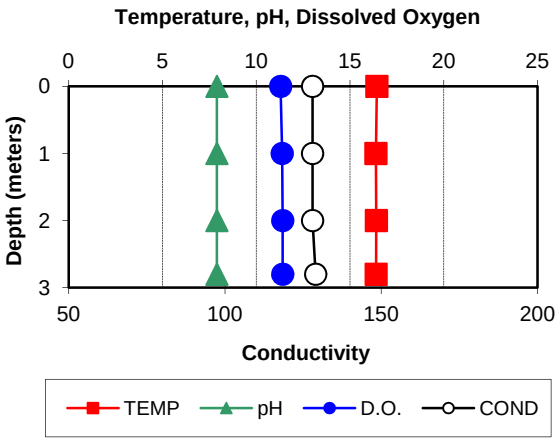


October 12, 2011

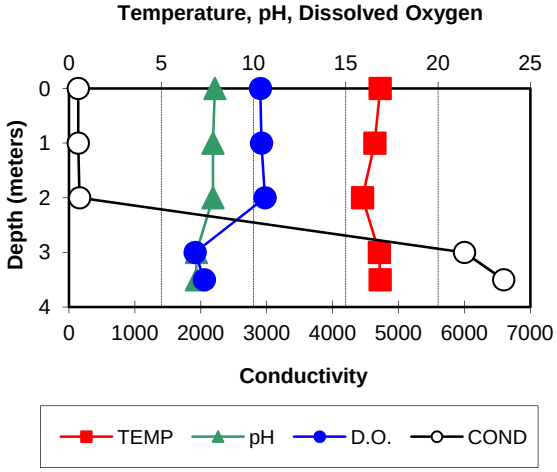


CAPITOL LAKE - MIDDLE BASIN

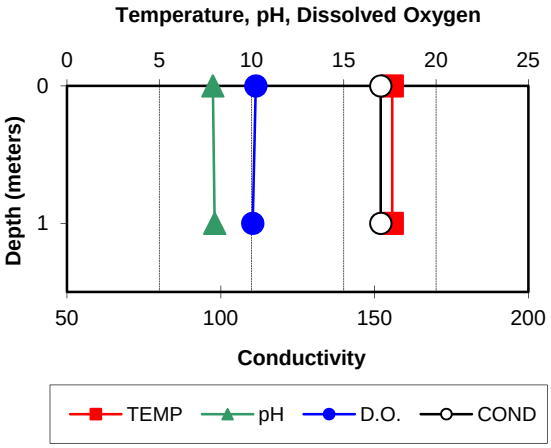
June 22, 2011



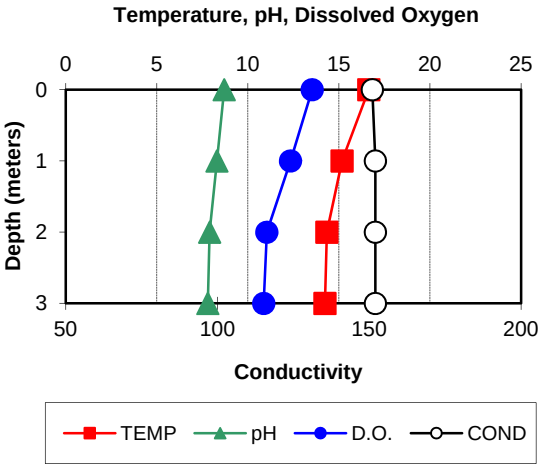
July 20, 2011



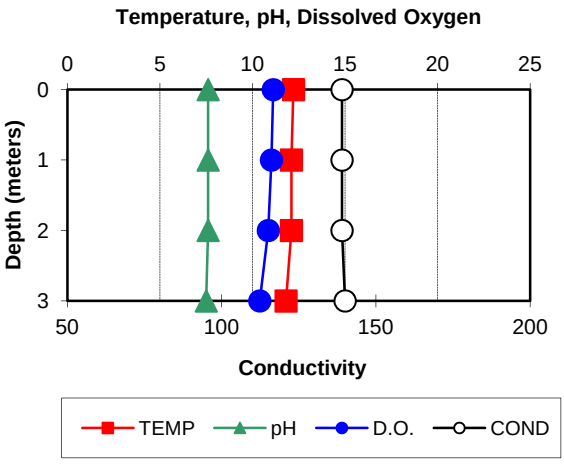
August 30, 2011



September 21, 2011



October 12, 2011



Thurston County Water Resources Annual Report - 2011

Capitol Lake @ Mid- North Basin

Site ID# *BUDCAL005*

Date	*Time*	*Bottom Depth m*	*Bottom Sample Depth m*	*Sur TP mg/L*	*Bott TP mg/L*	*Sur TN mg/L*	*Bott TN mg/L*	*Secchi m*	*Chl a ug/L*	*Phae a ug/L*	*Water*	*Lake Notes*
06/22/2011	2:30:00 PM	3	1.0	0.026		0.471		1.97	8.5	1.2	#6 yellow-green	Samples collected at 1M depth. Ammonia<0.010
07/20/2011												GA raised lake level for fish ladder repairs. Too high to get under RR tressel.
08/30/2011	8:45:00 AM	2.5	1.0	0.044		0.663		1.94	17	3.5	#6 yellow-green	Sample collected at 1M depth.
09/21/2011	2:30:00 PM	3.2	1.0	0.042		0.711		0.83	33	1.7	#6 murky yellow-green	Sample collected at 1M depth. Ammonia<0.010
10/12/2011	1:30:00 PM	2.5	1.0	0.034		0.779		1.91	20	1.9	#6 yellow-green	Sample collected at 1M depth.

Summary for 'Site Description' = Capitol Lake @ Mid- North Basin (5 detail records)

Averages: **Sur TP** *0.037*
Secchi *1.66*
Chl a *19.6*

Thurston County Water Resources Annual Report - 2011

Capitol Lake @ Mid- Middle Basin

Site ID# *BUDCAL015*

Date	*Time*	*Bottom Depth m*	*Bottom Sample Depth m*	*Sur TP mg/L*	*Bott TP mg/L*	*Sur TN mg/L*	*Bott TN mg/L*	*Secchi m*	*Chl a ug/L*	*Phae a ug/L*	*Water*	*Lake Notes*
06/22/2011	2:15:00 PM	2.8	1.0	0.031		0.587		2.10	3.7	2.6	#6 yellow-green	Samples collected at 1M depth.
07/20/2011	1:00:00 PM	3.5	1.0	0.031		0.782		2.72	4.3	2.5	#6 greenish-yellow	Samples collected at 1M depth.
08/30/2011	8:30:00 AM	1.2	0.8	0.041		0.522			2.7	2.6	#6 yellow-green	Samples collected at 0.75M depth. Visibility to bottom.
09/21/2011	2:00:00 PM	3	1.0	0.028		0.845			1.9	1.1	#6 yellow-green	Sample collected at 1M depth. Visibility to bottom.
10/12/2011	1:00:00 PM	3	1.0	0.033		0.901		2.05	3.2	1.3	#6 yellow-green	Sample collected at 1M depth.

Summary for 'Site Description' = Capitol Lake @ Mid- Middle Basin (5 detail records)

Averages:

Sur TP	*0.033*
Secchi	*2.29*
Chl a	*3.2*

Algae data: Capitol Lake @ Mid- North Basin

	Type	*Description*	*Dominant in*
06/22/2011			
	BG	Aphanizomenon species	
	DT	Cocconeis pediculus	
	DT	Cyclotella species	
	DT	Cymbella species	
	DT	Diatoms species	
	DT	Fragilaria species	
	DT	Synedra species	
	DT	Tabellaria species	
	GR	Ankistrodesmus species	
	GR	Crucigenia species	
	GR	Pandorina species	
	GR	Sphaerocystis species	
	YL	Dinobryon species	
08/30/2011			
	BG	Pseudanabaena species	
	CP	Cryptomonads	
	DF	Peridinium species	
	DT	Aulacoseira species	
	DT	Cyclotella species	
	DT	Diatoms species	
	DT	Rhizosolenia eriensis	
	DT	Synedra species	
	GR	Ankistrodesmus species	
	GR	Golenkinia species	
	GR	Scenedesmus species	

	Type	Description	Dominant in
09/21/2011			
	BG	Pseudanabaena species	
	CP	Cryptomonads	
	DT	Aulacoseira species	
	DT	Cocconeis pediculus	
	DT	Cyclotella species	
	DT	Diatoms species	
	DT	Synedra species	
	GR	Actinastrum species	
	GR	Ankistrodesmus species	
10/12/2011			
	BG	Pseudanabaena species	
	DT	Cocconeis pediculus	
	DT	Cyclotella species	
	DT	Synedra species	
	GR	Actinastrum species	
	GR	Spondylosium species	

Key: *BG = Blue green*, *CP = Cryptophyte*, *DF = Dinoflagellate*, *DT = Diatom*, *EU = Euglenophyte*, *GR = Green*, *YL = Yellow*

Algae data: Capitol Lake @ Mid- Middle Basin

	Type	*Description*	*Dominant in*
06/22/2011			
	BG	Oscillatoria species	
	DT	Cocconeis pediculus	
	DT	Cymbella species	
	DT	Diatoms species	
	DT	Gyrosigma species	
	GR	Staurastrum species	
07/20/2011			
	BG	Oscillatoria species	
	CP	Cryptomonads	
	DF	Peridinium species	
	DT	Cyclotella species	
	DT	Cymbella species	
	DT	Diatoms species	
	DT	Fragilaria species	
	DT	Navicula species	
	GR	Ankistrodesmus species	
08/30/2011			
	CP	Cryptomonads	
	DF	Peridinium species	
	DT	Cocconeis pediculus	
	DT	Diatoms species	
	EU	Trachelomonas species	
	GR	Scenedesmus species	
09/21/2011			
	CP	Cryptomonads	
	DF	Peridinium species	
	DT	Cocconeis pediculus	
	DT	Cyclotella species	
	DT	Diatoms species	

	Type	Description	Dominant in
10/12/2011			
	DT	Cocconeis pediculus	
	DT	Diatoms species	
	DT	Fragilaria species	
	DT	Rhoicosphenia species	
	DT	Synedra species	

Key: *BG = Blue green* *EU = Euglenophyte*
CP = Cryptophyte *GR = Green*
DF = Dinoflagellate *YL = Yellow*
DT = Diatom