

Echo Lake

Echo Lake has moderate water clarity, low to moderate nutrient concentrations, and moderate algae. Water clarity has increased in recent years; however, severe oxygen depletion and increasing nutrients are signs of eutrophication. The lake appears to be at risk of future declines in water quality unless nutrient runoff from the watershed is controlled.

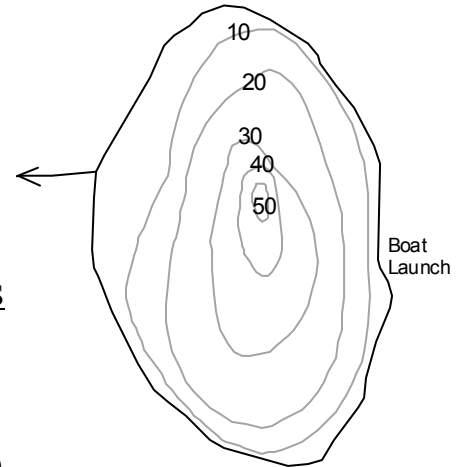


State of the Lakes Report
March 2003

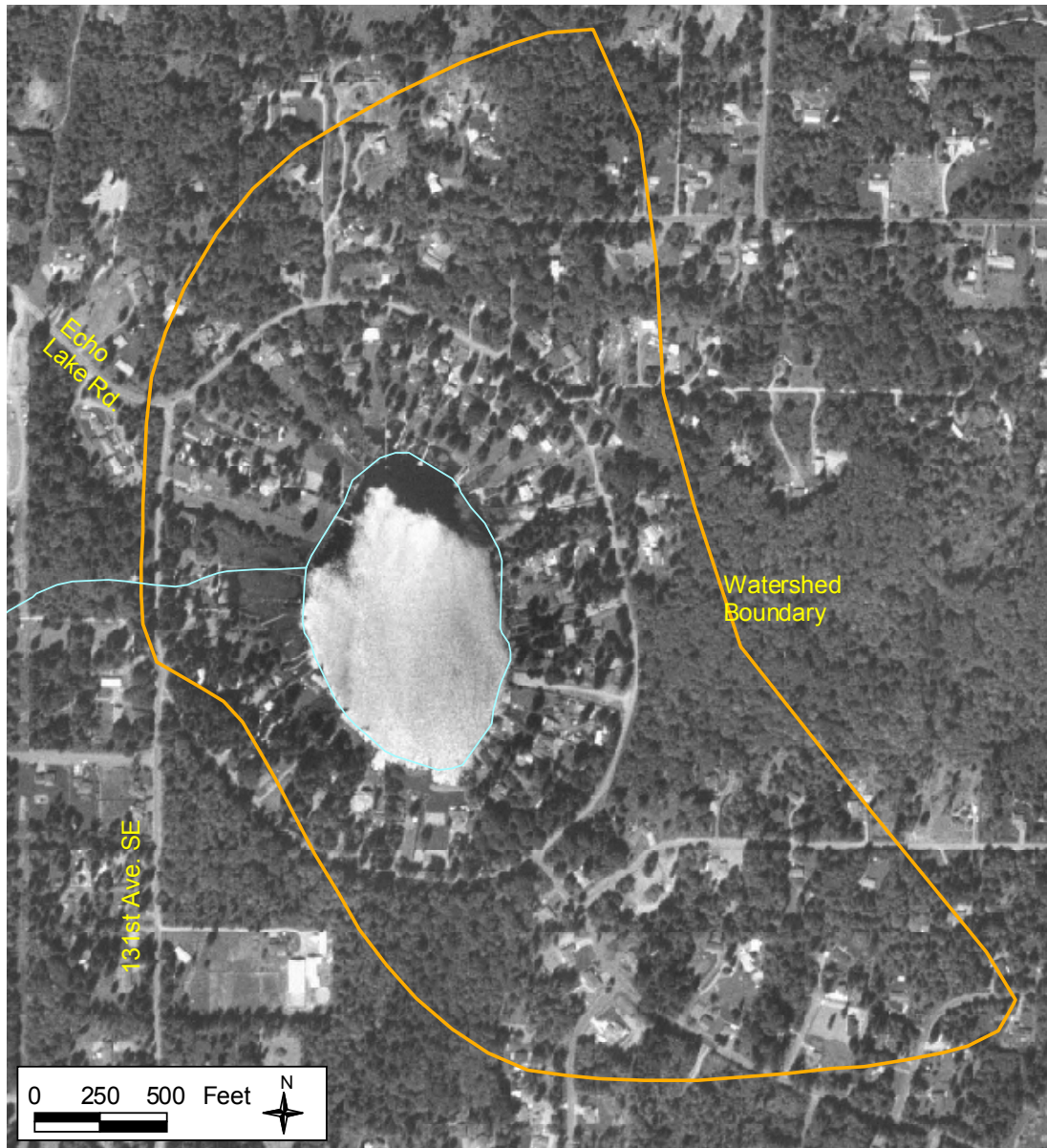
Snohomish County Public Works
Surface Water Management

LAKE AND WATERSHED DATA

Lake Area: 16 acres
 Watershed Area: 172 acres
 Watershed to Lake Area Ratio: 10.8
 Maximum Depth: 50 feet (15.2 meters)
 Average Depth: 17 feet (5.2 meters)
 Lake Volume: 290 acre-feet
 Length of Shore: 0.6 miles



	<u>1973</u>	<u>MID-90'S</u>
# of nearshore homes	29	44
# of homes/1000' of shoreline	8.7	13.2
% of homes with bulkhead or fill		57%
% of homes with some native vegetation near shore		41%
% of watershed developed (residential or commercial)	10%	65% (est.)



LAKE ASSESSMENT

DESCRIPTION

■ Location/Access – Echo Lake is located about four miles southeast of Maltby between Highway 522 and the Snohomish-King County line. Echo Lake is spring-fed and drains to Bear Creek, which flows into the Sammamish River and Lake Washington. A wetland is located on the west side of the lake near the outlet. There is a public boat launch located on the east side of the lake. Gas-powered boats are not permitted.

■ Size/Shape – Echo Lake is a small but relatively deep lake. The lake is roughly circular, suggesting that it is a kettle lake formed by a melting ice block. The lake is 16 acres in size, with a maximum depth of 15.2 meters and an average depth of 5.2 meters. The lake volume contains 290 acre-feet of water. The steep-sided bowl shape of the lake contributes to the strong stratification that occurs during the summer.

■ Watershed – The Echo Lake watershed, including the lake, covers 172 acres. The watershed is 10.8 times the size of the lake, which is near the median for Snohomish County lakes. In 1973, approximately 10% of the watershed was developed with residential uses. By the mid-1990s, residential development covered approximately 65% of the watershed, making this one of the fastest growing and most densely populated lake watersheds in the county.

■ Shoreline – The shoreline of Echo Lake is 0.6 miles in length. Along the shoreline, there were 29 nearshore homes in 1973. By the mid-90s, there were 44 homes around the lake, giving this small lake the third most densely developed shoreline in the county. Approximately 57% of the homes have modified the shoreline with bulkheads or fill. About 41% of the homes have retained some native vegetation along the shore, which is important for filtering pollution.

LAKE CONDITIONS

■ Water Clarity – Summer water clarity in Echo Lake averaged between 2.9 and 3.6 meters from 1992 through 1996. Single measurements in 1959 and 1973 were much lower—2.9 and 2.1 meters,



respectively. Since 1998, summer water clarity averages have increased to between 3.8 and 4.5 meters. Analysis shows that there has been a statistically significant increase in water clarity between 1992 and 2002. The causes of this trend are unknown. However, in the 1950s, the lake was fertilized to boost algae and fish production. The current trend toward improved water clarity may be the result of the gradual use and depletion of these nutrients.

■ Color – The lake water is moderately colored by dissolved organic (humic) material from wetlands near the lake. The water is generally described as light brown or light green.

■ Nutrients – Summer average total phosphorus concentrations in the epilimnion ranged from 7 to 10 $\mu\text{g/l}$ from 1996 to 2002, which is relatively low for Snohomish County lakes. One sample in 1973 was slightly higher. Total phosphorus averages in the hypolimnion were substantially higher than in the epilimnion, ranging from 25 to 44 $\mu\text{g/l}$ from 1996 to 2002. This suggests a moderate release of phosphorus from the bottom sediments during times of oxygen depletion. Total nitrogen levels were moderate to high in 1973, so phosphorus availability probably limits algal growth.

■ Alkalinity – Limited data from the early 1990s indicate that Echo Lake has a low buffering capacity and may be sensitive to nutrient pollution.

■ Oxygen/Temperature – Vertical profiles of dissolved oxygen and temperature for the summers of 1995 to 2002 show very strong stratification

between warm, oxygenated upper waters and cool, oxygen-depleted bottom waters. The graphs indicate that decaying organic matter in the lake sediments depletes the dissolved oxygen in the water below about 5 or 6 meters by mid to late summer. Often, there were also spikes in dissolved oxygen at 3 to 4 meters depth, suggesting vigorous algal growth at this level. Observations by citizen volunteers and SWM staff through the years indicate that water from the hypolimnion emits a sulfurous or rotten-egg smell, sometimes beginning at 6 meters and increasing with depth. This smell comes from hydrogen sulfide, which is a by-product of the organic decomposition occurring in the lake sediments. At high levels, this chemical can be toxic to fish.

- Algae – Limited chlorophyll *a* samples taken during the summers of 1994, 1995, and 2002 produced values ranging from 1.3 to 9.9 µg/l, indicating moderate amounts of algae in the lake. Analysis of three algae samples in 1994-95 revealed moderate volumes, dominated by gold-browns and diatoms, with little blue-green algae. Lake monitors have noted occasional algal blooms in the lake.

- Aquatic Plants – Echo Lake supports a sparse and patchy growth of aquatic plants in a band around the lake. It is unclear why the lake, with an adequate shallow water zone and rich sediments, does not produce more aquatic plant growth. The dominant plant is the native yellow water-lily. Other aquatic plants growing in the lake include elodea, watershield, muskgrass, quillwort, and pondweeds. Much of the lake shore, especially on the west, is ringed with emergent native plant species, predominantly cattails.

- Waterfowl – Echo Lake has a problem with excess waterfowl. Resident Canada geese and domestic and migratory ducks are numerous during much of the year. Waterfowl droppings are unpleasant and pollute the water with nutrients and bacteria.

- Other Lake Life – In some years, especially 1995, numerous large bryozoans have been observed in Echo Lake growing on underwater tree limbs and plant stems. Bryozoans are jelly-like, colonial, filter-feeding animals that are often indicators of good water quality.

SUMMARY

- Trophic State – Based on moderate water clarity, low to moderate phosphorus concentrations, moderate algal productivity, low levels of aquatic plants, and severe oxygen depletion, Echo Lake may be classified as mesotrophic.

- Current Conditions/Trends – Echo Lake is currently in satisfactory condition, and monitoring data show a statistically significant trend toward improving water clarity since 1992. However, the lake shows signs of eutrophication, such as severe oxygen depletion, abundant hydrogen sulfide, build-up of phosphorus in the bottom waters, and periodic algal blooms. Therefore, the lake appears to be at risk for a future decline in water quality.

- Future Concerns/Targets – The primary concern with Echo Lake is the potential for water quality impacts that may result from continued land development. The watershed and lake shore have experienced rapid development in recent years and are located in an area where more growth is expected. The large numbers of waterfowl are also a significant source of nutrients to the lake. Maintaining the current water clarity and phosphorus levels is the target for the lake.

- Recommendations – The lake should be monitored carefully to determine if water clarity remains at the levels of recent years, if nutrient levels increase, and if algal blooms become more frequent. New development in the watershed should take precautions to control runoff and reduce nutrient pollution. Existing homes on the lake shore should be encouraged to re-create buffers of native vegetation to filter out pollution before it reaches the lake. Resident waterfowl need to be controlled.

CITIZEN VOLUNTEERS

Thanks to Gerald Dickson and Bernice Engel for many years of volunteer monitoring at Echo Lake.

DATA SUMMARY TABLE

Source	Date	Secchi Depth (meters)	Total Phosphorus (ug/l)		Color (Pt-Co scale)	Chlorophyll a (ug/l)
			Surface	Bottom	Epilimnion	Epilimnion
Menasveta, 1961	7/59	2.9	-	-	-	-
Bortleson, et al, 1976	8/3/73	2.1	15	31	30	-
Volunteer	Summer 1992	2.8 - 3.8 (3.3) n = 8	-	-	-	-
Volunteer	Summer 1993	2.3 - 4.8 (3.6) n = 11	-	-	-	-
SWM Staff or Volunteer	Summer 1994	2.6 - 4.6 (3.6) n = 12	-	-	15 - 20 (18) n = 2	2.4 - 5.9 (4.2) n = 2
SWM Staff or Volunteer	Summer 1995	2.2 - 3.4 (2.9) n = 6	-	-	25	9.9
Volunteer	Summer 1996	3.1 - 3.7 (3.3) n = 3	6 - 9 (8) n = 2	36 - 40 (38) n = 2	-	-
SWM Staff or Volunteer	Summer 1997	2.6 - 5.2 (3.7) n = 7	10 (10) n = 2	30 - 58 (44) n = 2	-	-
SWM Staff or Volunteer	Summer 1998	3.2 - 5.3 (4.5) n = 6	7 - 13 (10) n = 4	21 - 40 (27) n = 4	-	-
SWM Staff or Volunteer	Summer 1999	3.5 - 4.0 (3.8) n = 4	7 - 9 (9) n = 4	24 - 26 (25) n = 4	-	-
SWM Staff	Summer 2000	3.9 - 4.3 (4.1) n = 3	7 - 8 (7) n = 3	21 - 32 (26) n = 3	-	-
SWM Staff	Summer 2001	3.8 - 5.5 (4.6) n = 4	7 - 13 (10) n = 4	31 - 41 (36) n = 4	-	-
SWM Staff	Summer 2002	3.2 - 5.0 (3.9) n = 4	7 - 11 (9) n = 4	24 - 32 (27) n = 4	-	1.3 - 4.8 (3.3) n = 4

NOTES

- Table includes summer (May-Oct) data only.
- Each box shows the range on top, followed by summer average in () and number of samples (n).
- Total phosphorus data are from samples taken at discrete depths only.

SUMMARY OF OTHER DATA

■ ***Total Nitrogen*** – single samples in 1973 showed 0.47 mg/l in the epilimnion and 1.12 mg/l in the hypolimnion; which suggests that nitrogen was abundant and not limiting algal growth.

■ ***Alkalinity*** – limited data from 1994 and 1995 ranged from 20 -- 32 mg/l CaCO₃, which suggests that Echo has a moderately low buffering capacity and may be sensitive to nutrient pollution.

■ ***pH*** – readings from 1994 through 2000 averaged 7.1 near the surface and 6.4 near the bottom, which is within the normal range for Snohomish County lakes. 2001-2002 readings were similar.

■ ***Conductivity*** – 1994-2000 data averaged 58 µmhos in the epilimnion and 80 µmhos near the lake bottom, indicating moderate levels of dissolved materials in the water. 2001-2002 readings were similar.

■ ***Iron*** – limited 1994-95 data showed moderate levels in the epilimnion (avg. 104 µg/l) and high levels in the hypolimnion (avg. 1073 µg/l, high of 2100 µg/l), which indicates release of iron and phosphorus from the bottom sediments under low oxygen conditions.

■ ***Algae*** – the following table shows the total biovolume and percent biovolume of the main types of algae from three samples collected in 1994-95. The data show that gold-browns and diatoms were most prevalent. Cell counts of the same samples revealed that greens, gold-

brown/diatoms, cryptomonads, and euglenoids were most abundant.

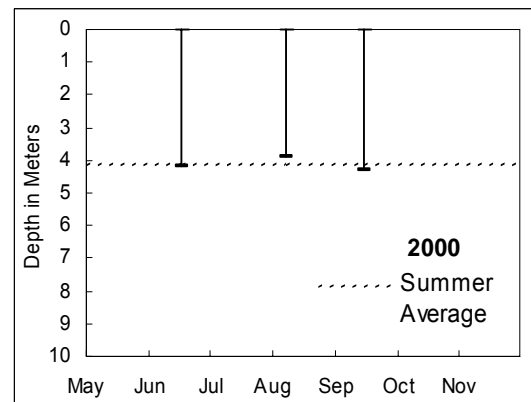
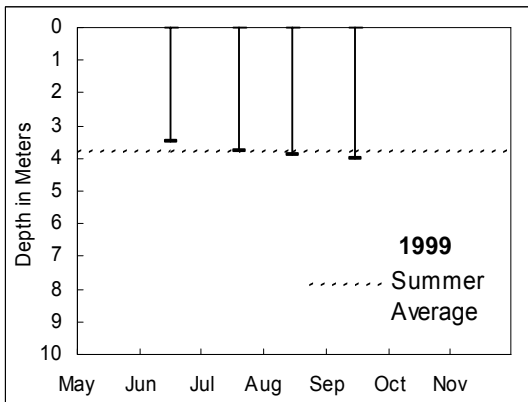
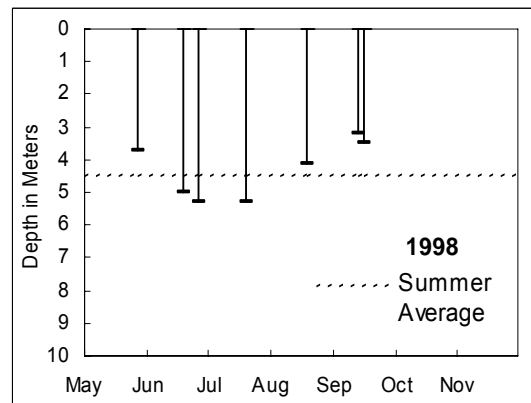
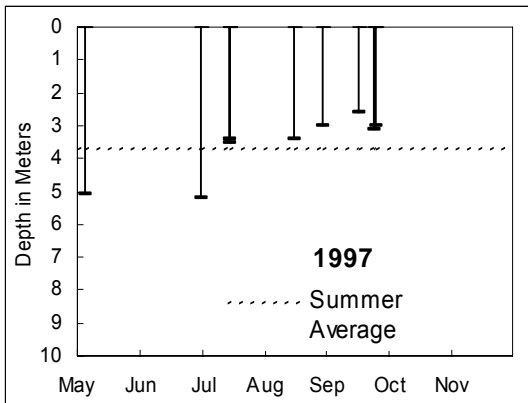
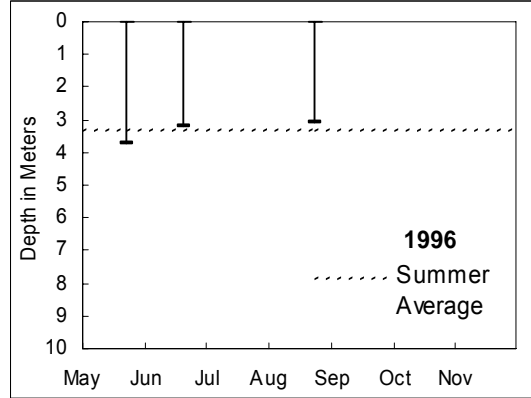
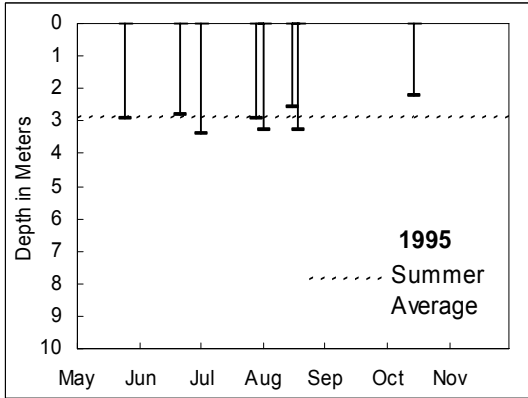
ALGAE TYPES	7/13/94	9/16/94	8/17/95
Cyanophyta (Blue-greens)	4%	0%	1%
Chlorophyta (Greens)	40%	2%	2%
Chrysophyta (Golden/diatoms)	42%	42%	63%
Cryptophyta (Cryptomonads)	13%	20%	28%
Euglenophyta (Euglenoids)	0%	11%	0%
Pyrrhophyta (Dinoflagellates)	1%	25%	7%
TOTAL BIOVOLUME (mm ³ /l)	0.678	0.671	1.204

■ ***Fish*** – according to the Washington State Department of Fish and Wildlife (WDFW), fish species found in Echo Lake include rainbow trout and pumpkinseed sunfish. WDFW usually stocks the lake each year with rainbow trout.

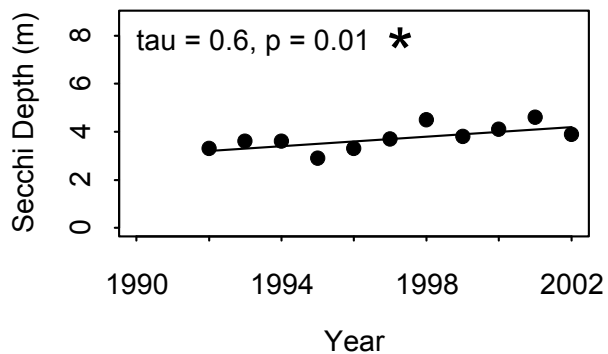
DATA SOURCES

In addition to data from Snohomish County SWM staff and citizen volunteers, data for Echo Lake are also available from: Bortleson, et. al., 1976 and Menasveta, 1961. Please refer to the full list of references in the County-Wide Summary.

WATER CLARITY

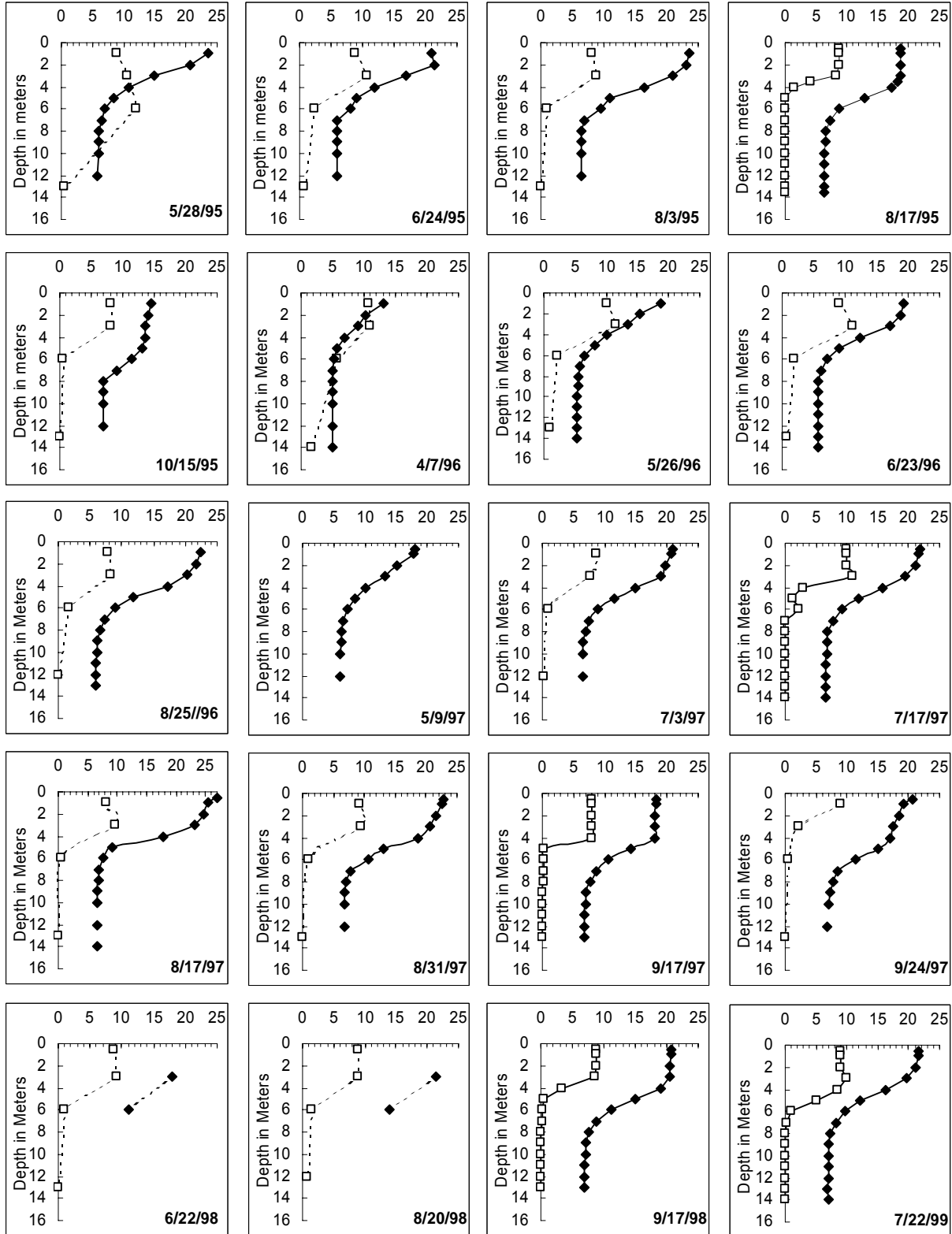


TREND ANALYSIS

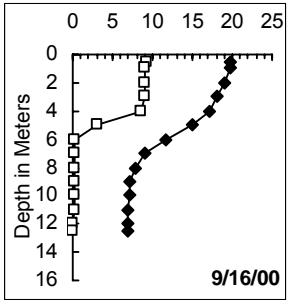
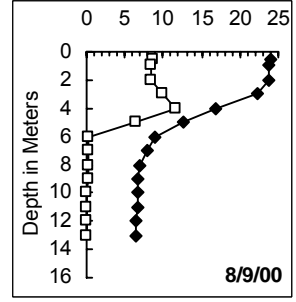
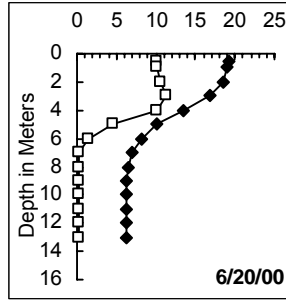
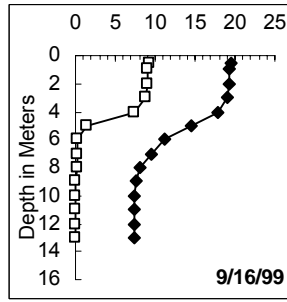
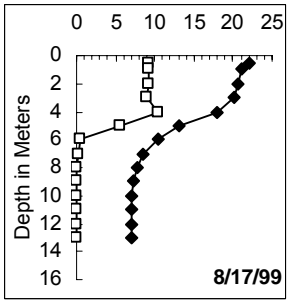


* Statistically significant trend ($p \leq 0.10$)

DISSOLVED OXYGEN AND TEMPERATURE PROFILES (SELECTED YEARS)

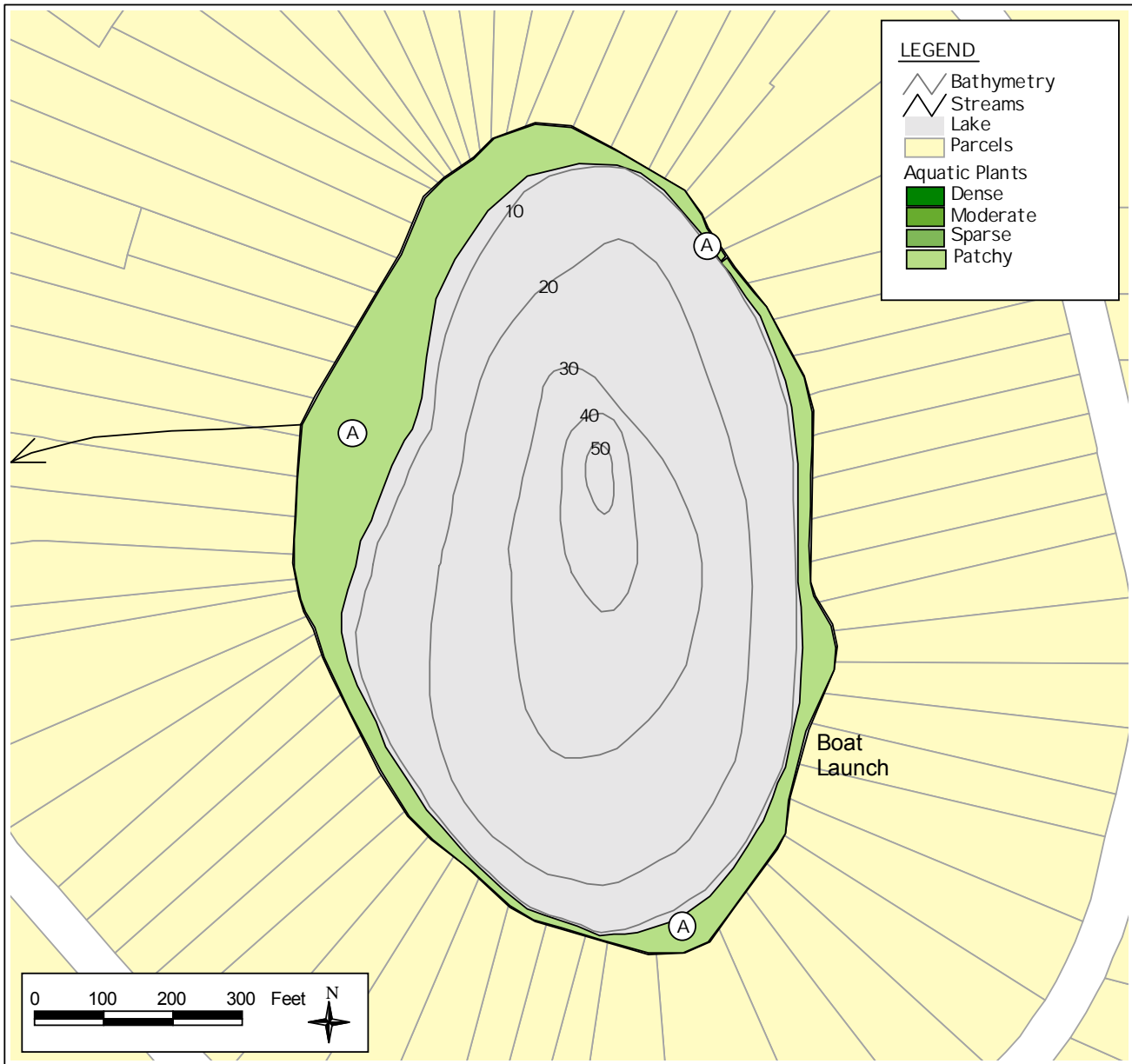


—□— DO (mg/l) —◆— Temp (°C)



—□— DO (mg/l) —◆— Temp (°C)

AQUATIC PLANTS



Area	Density	Dominant Plants	Other Plants
A	Sparse	<i>Nuphar polysepalum</i> (Yellow water-lily)	<i>Elodea canadensis</i> (Common elodea) <i>Brasenia schreberi</i> (Water shield) <i>Chara</i> sp. (Stonewort, Muskgrass) <i>Eleocharis</i> sp. (Spikerush) <i>Potamogeton</i> sp. (Thin-leaf pondweed) <i>Sagittaria subulata</i> (Aw.-leaf arrowhead)?

Note: Much of the lake shore, especially on the west, is ringed with emergent *Typha* sp. (Cattail); also *Polygonum* sp. (Water smartweed), *Menyanthes trifoliata* (Bogbean), and *Spiraea douglasii* (Hardhack) are found along shoreline.

BASIC MONITORING DATA

1995									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
2/22/95			26.8	8.63		trace			Approx 11 coots & 2 hybrid mallard.
4/16/95	3.9	18	13	8.88	10	trace	light	ltbrown	Fishy odor at surface. Approx 3 small mallards.
5/28/95	2.9	26.7	24	12.4	0	none	light	ltbrown	Rotten egg odor 6-13 meters.
6/5/95		11.5	20.5	13.8	90	moderate		ltbrown	Approx 24 geese. Rotten egg odor at 13 meters.
6/24/95	2.8	24.4	24	15.3	0	none	light	ltbrown	Approx 66 geese. Rotten egg odor 8-13 meters.
7/4/95	3.4	24.5		17.4	90	light	light		
7/18/95		35.5	27	20					
7/31/95	2.9	24.5		22.5	0	none	light		Buoy had been moved.
8/3/95	3.3	23.5	23.5	23.3	0	none	light	ltbrown	Rotten egg odor below 7 meters; 11 canada geese
*08/17/95	2.6				100	moderate	light	medbrown	Many large Bryozoans. Fewer plants than 1994; thick periphyton.
8/20/95	3.3	24	21.5	23	0	trace	calm	ltbrown	3 canada geese, 38+ ducks
10/15/95	2.2	20	14.5	22.8	90	none	light	ltbrown	2 large lots on SE side of lake at main stream being cleared without grading permit. Stop work order 10-15-95. Numerous seeds floating on water.
11/19/95	3.1	10	10	9.5	10	light	light	ltbrown	Fall turnover has begun.
12/26/95	5.2	5.5	4.5	9.8	25	none	calm	ltbrown	No algae or scum

1996									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
4/7/96	4.3	24	15.5	9.25	10		light	ltgreen	No algae or scum
5/26/96	3.7	21	19	9.5	0	none	light	ltbrown	Canada geese 1 pr. 5 goslings no large numbers now. readings taken at deepest area of lake buoy. Bright sun. no odor,
6/23/96	3.2	19.2	19	13.3	90	light	light	ltbrown	One home owner in lake has installed 1 hp pump for irrigation. Slight rotten egg odor. 12+ mallards, 18 canada geese.
8/25/96	3.1	25	22.5		90	none	calm	ltbrown	Fewer geese this summer. TP samples taken for SWM 1M below surface & 12 M (1M above bottom) no algae, scum, plants, H2S odor.

Non-summer data indicated by shading.

*Indicates data collected by Snohomish County staff.

1997

DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
5/9/97	5.1	21.5	18.1	9.5	0	none	light	lt brown	1 mallard, 9 ducklings. Large # clumps of algae (yellow-green, brown, green)-SE side of lake.
7/3/97	5.2	21	20.8	9.88	10	trace	light	lt brown	Slight odor at 13m. 61 Canada geese. 2 new, large homes built on S shore of lake.
*07/17/97	3.6				10	none	calm	ltgrnbrn	sulphur smell 9m and below.
8/17/97	3.4	30.5	26.9	17.8	0	none	calm	lt brown	Slight odor at 9-10 meters, heavy at 12 meters and below. 12 Canada geese, 82 Canada geese flew away - early August.
8/31/97	3.0	25	22.7	19	0	none	light	lt brown	Slight odor 8-9 meters, increasing with depth, heavy at bottom. 9 Canada geese, 1-2ducks.
*09/17/97	2.6				100	mod	breezy	grnbrown	
9/24/97	3.1	22	20.7		0	none	light	lt brown	Slight odor at 6 meters, increasing with depth, heavy at bottom. 12-15 Kingfisher, 27 Canada geese. Bryozoan colonies 0.5-1 meter deep, S, W & N sides of lake.
9/25/97	3.0	22.5	20.8		75	none	light	lt brown	Slight-moderate odor 6-8 meters. 14 Canada geese. 3 dead tadpoles & 1-12" trout found along N shore this week. DO 4 meters = 8.6 mg/L.
11/21/97	2.6		9	8.88	10		calm		Moderate odor at 13m.
12/2/97	2.2		7.8	12.8	10	none	light	lt brown	No odor. 60 Common mergansers, no Canada geese, 35 coots, 2 mallards. Two new homes being built on lake.

1998

DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
3/29/98	2.7	12.8	10.2	12	10		light	lt brown	No odor.
5/31/98	3.7	22.8	18.5	13	10	none	light	lt brown	No odor, slight algae. 11 geese and 6 goslings.
6/22/98	5.0	21.5	24	15.8	10	none	light	lt brown	Odor at 13M (rotten egg); 79 Canada Geese.
6/29/98	5.3	22	21.5	15.6	0	none	light		Odor at 13M (rotten egg); dead male mallard at Engle's lot.
7/22/98	5.3	26.5	25	17.5	0	none	calm	lt brown	
8/20/98	4.1	25.6	24	27.1	10	none	light	lt brown	Slight rotten egg odor @ 13.5m; 5 Canada geese; small population of ducks.
9/14/98	3.2	21.7	21.5	33	0	none	light	lt brown	Slight rotten egg odor; 7 Canada Geese; small # of ducks.
*9/17/98	3.5				50	none	light	lt green	8 geese, 9 ducks. Slight plants, algae; no scum. Water level extremely low. One house doing bulkhead work in water.

1999									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
6/19/99	3.5	21.5	19.5		75	trace	light		Lake level high, marker was ~ 1' under water. Light musty odor from bottom sample.
*7/22/99	3.8	18	21.5		100	light	calm	medgreen	
*8/17/99	3.9	23	22.17		0	moderate	light	grnbrown	Moderate H ₂ S odor from 12 m sample.
*9/16/99	4	15	19.5		100	none	calm	yellowgrn	Heavy H ₂ S odor from 12 m sample.

2000									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
*06/20/00	4.2	20	19.31		10	none	calm	lt grnbrown	7 ducks, moderate algae and aquatic plants, and no algae scum.
*08/09/00	3.9	20	23.99		0	none	calm	lt green	No ducks, slight algae and aquatic plants, and no algae scum.
*09/16/00	4.3	20	19.8		100	none	calm	medyelgrn	5 ducks, moderate algae and aquatic plants, and no algae scum.

[Click here to view more recent data.](#)

HOW YOU CAN HELP ECHO LAKE

- Educate yourself about lake ecology and the lake's health.
- Use lawn and garden fertilizers sparingly; test your soil first; choose low or no phosphorus fertilizers.
- Retain or plant native vegetation adjacent to the water to protect the shoreline and filter pollution.
- Infiltrate or filter the runoff from rooftops, patios, and driveways rather than piping it to the lake.



- Cover or mulch bare soil areas.
- Use pesticides, herbicides, and household chemicals sparingly and never near the water.
- Maintain your septic system—have it inspected every two years and pumped when needed.
- Conserve water both inside and outside.
- Clean up pet wastes and keep livestock away from the lake shore.

- Learn to identify non-native invasive aquatic plants and animals; check your boat and trailer for invaders; never empty an aquarium into the lake.
- Do not feed geese or ducks.
- Join with neighbors or the local property owners' association to work together to protect the lake.



Contact Snohomish County Surface Water Management at 425-388-3464 for information about these topics or if you have questions about Echo Lake.

(TTY users call 425-388-3700)