

**2004 Results**  
**Ambient Water Quality Monitoring**  
**Lakes and Streams**

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# History of King County's Ambient Monitoring Program

- ✦ Began with Metro - following diversion of wastewater from lakes Washington and Sammamish
- ✦ Designed to monitor:
  - Wastewater conveyance system that crosses lakes and influent streams
  - Pump systems along shoreline
  - Track long-term water quality





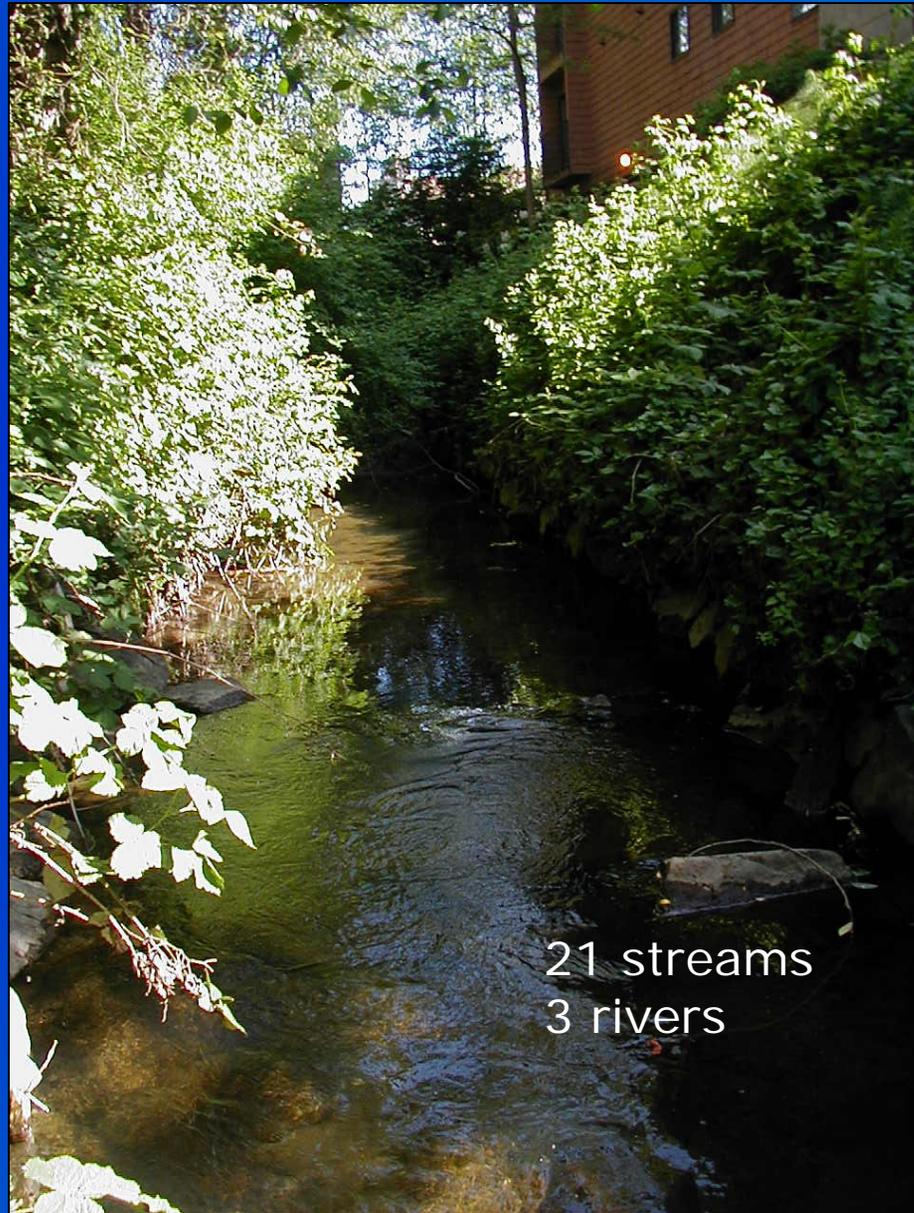
Routine monitoring in rivers and streams began early 1970's

Routine monitoring lakes began early 1980's



# Ambient Stream Monitoring

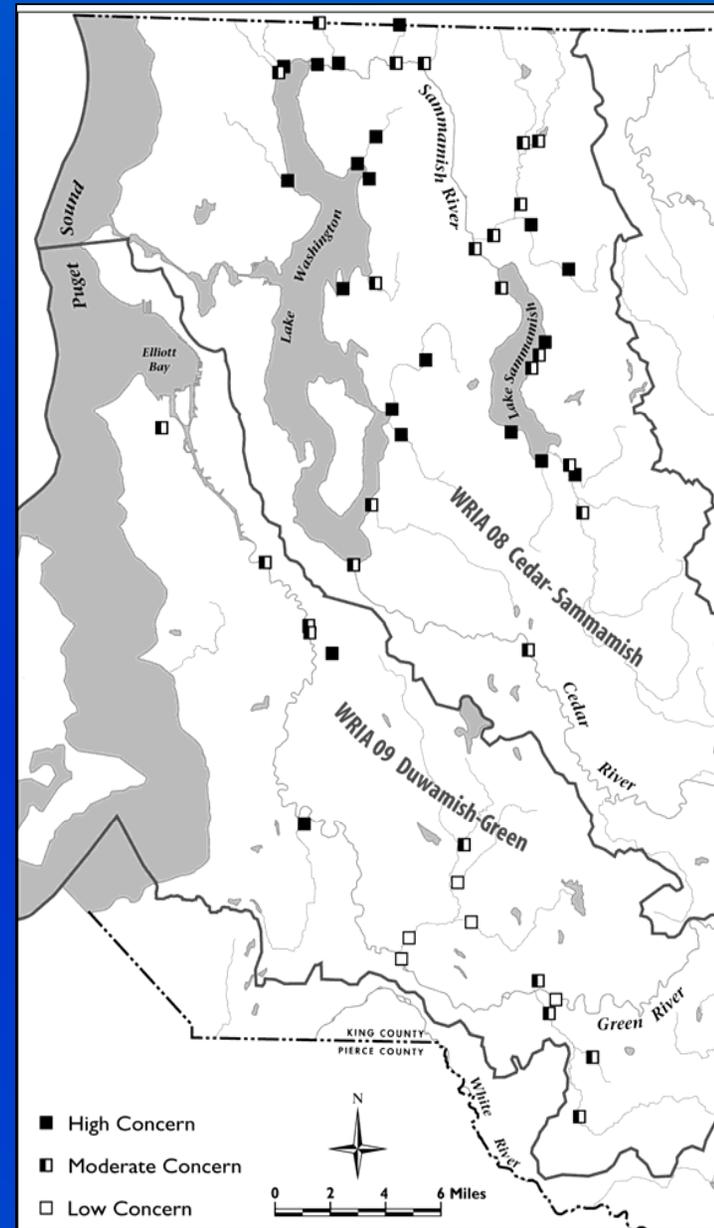
- ◆ 55 sampling sites
- ◆ Sampled monthly
  - bacteria
  - temperature
  - nutrients
  - oxygen
  - pH
  - turbidity & tss
- ◆ Sediment Sampling



21 streams  
3 rivers

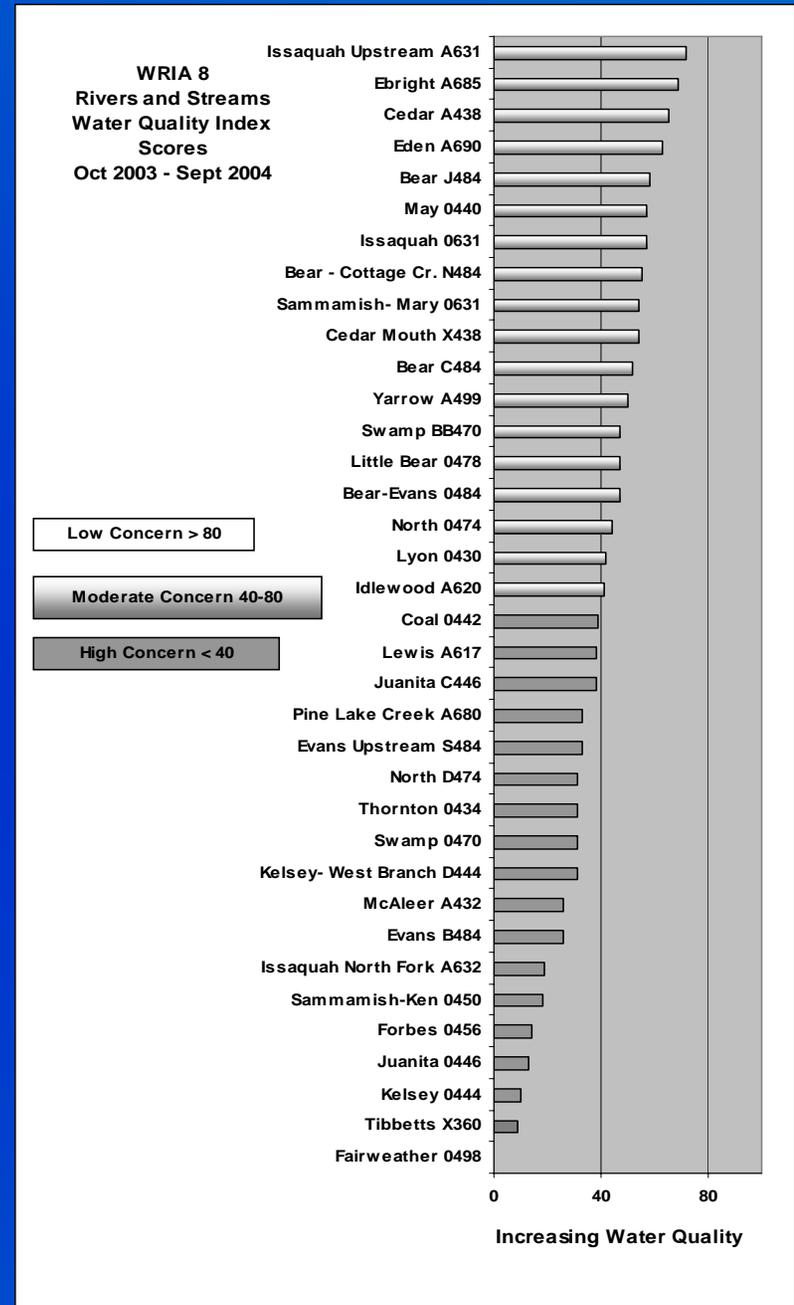
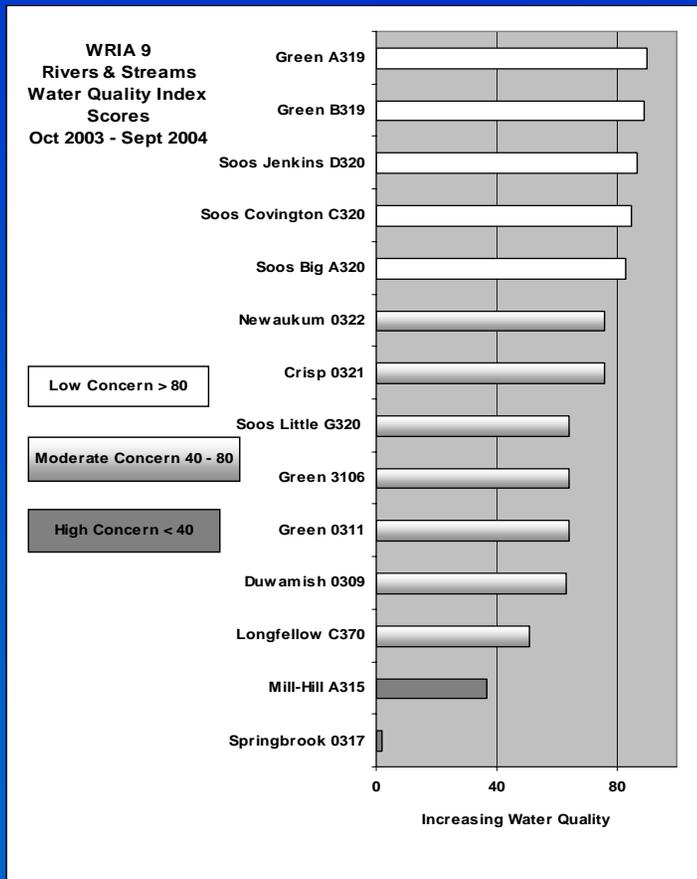
# Water Quality Index Rivers and Streams

- ◆ Index developed by Ecology
- ◆ Based on temperature, bacteria, pH, and nutrient measurements
- ◆ Ratings (0 – 100) are relative to levels expected to maintain beneficial uses
  - WQI > 80 = “Low Concern”  
(Good Water Quality)
  - WQI < 40 = “High Concern”  
(Poor Water Quality)



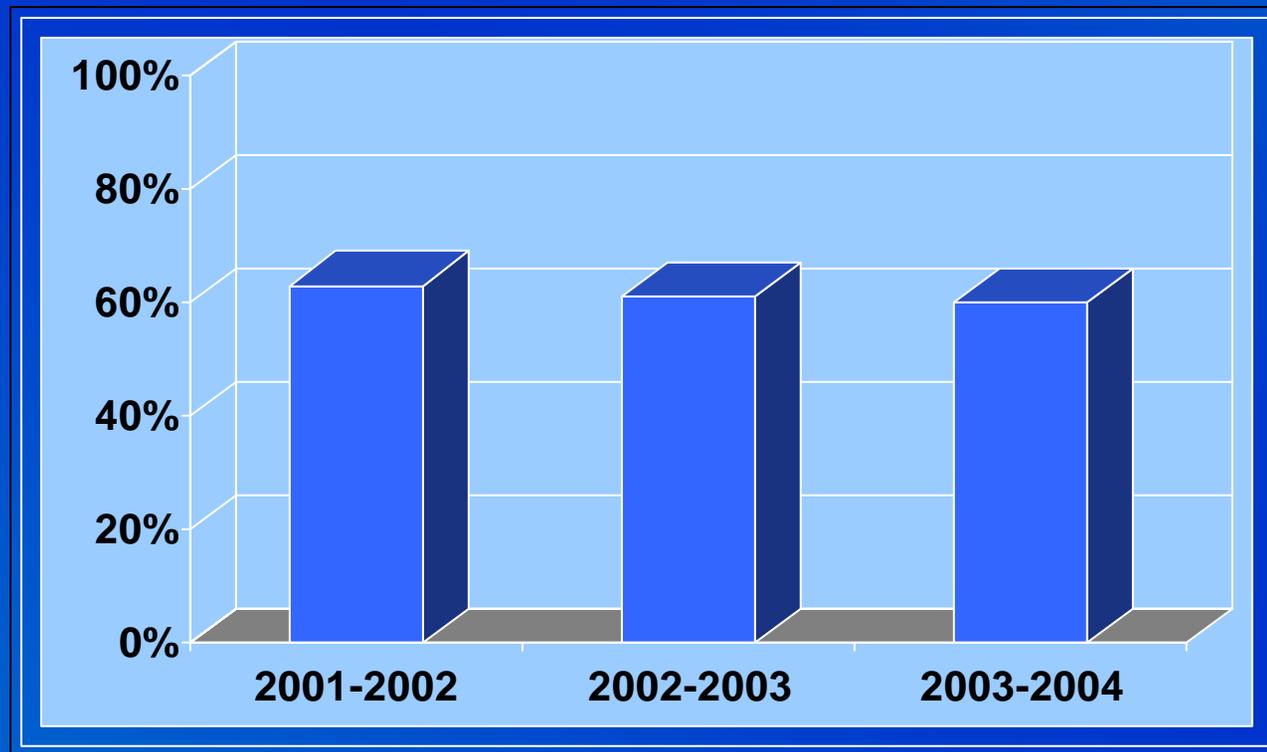
WQI Oct 2003 – Sept 2004

# 2004 WQI Individual Ratings



# Percent King County Streams with “Low to Moderate Concerns”

Based on WQI Ratings



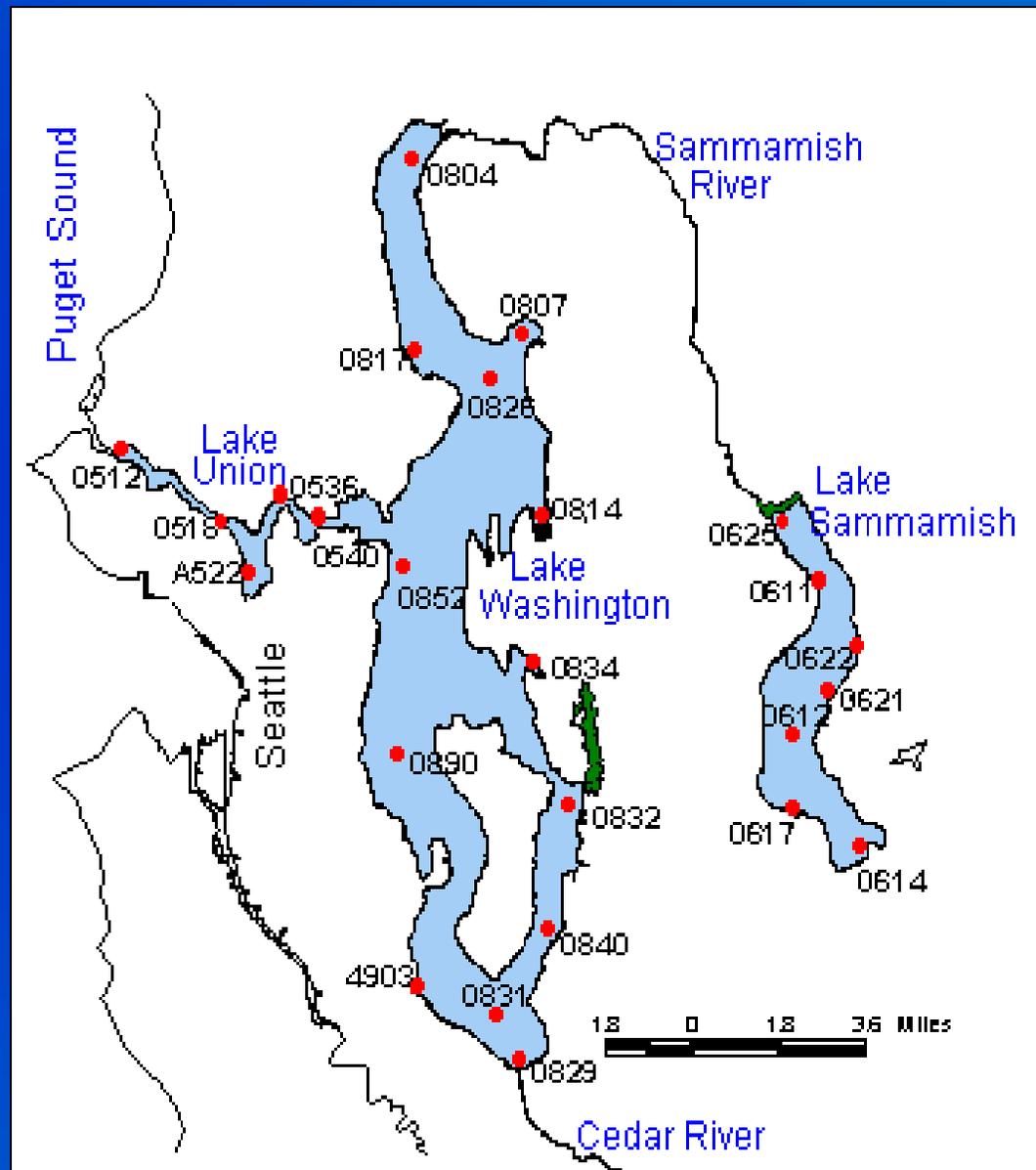
# 25 Year Long-term trends

1979 - 2004

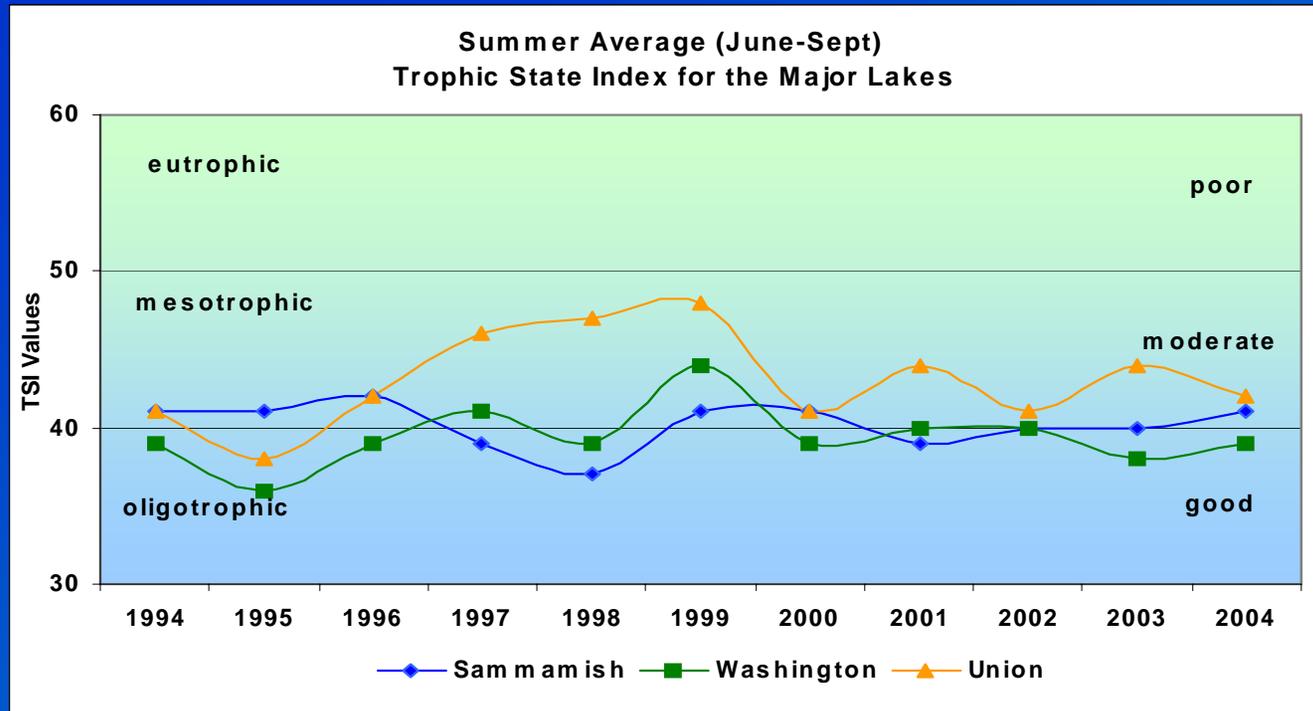
STREAM	SITE	TEMP	DO	COND	PH	TURB	TSS	ORTHO-P	TOTAL-P	NH3	NO3	TOTAL-N	FECAL
BEAR ABOVE COTTAGE	J484	+	-	+			-	-	-	-	-	-	-
BEAR-COTTAGE CREEK	N484	+	-	+			-	-	-	-	+	-	-
BEAR-EVANS	484	+		+	+	+	-	-	-	-	-	-	-
BEAR-EVANS ABOVE EVANS	C484	+	-	+			-	-	-		+	-	-
CEDAR MOUTH	X438	T O O	F E W	D A T A									
CEDAR-JONES RD	A438	+			+		-	-	+	-	-		
COAL	442	+		-	-	+	-	-					+
CRISP	321					+		+			-	-	+
DUWAMISH INTERURBAN	311	+	-		-			-					-
EBRIGHT	A685	T O O	F E W	D A T A									
EDEN	A690	T O O	F E W	D A T A									
EVANS MOUTH	B484	+	-	+	-	-	-	-	-		-	-	-
EVANS UPSTREAM	S484	+	-	+	-		-	-	-	-	-	-	-
FAIRWEATHER	498	+		-					+		-	-	-
FORBES	456	+	-	+	-			-			-	-	-
GREEN ABOVE NEWAUKUM	B319		-		-	-	-	-	+				
GREEN ABOVE SOOS	A319		-		-		-	-					-
IDLEWOOD	A620	T O O	F E W	D A T A									
ISSAQUAH MOUTH	631	+		+				-			-	-	
ISSAQUAH NORTH FORK	A632	+		+	-	-	-	-	-	+	-	-	-
ISSAQUAH UPSTREAM	A631	+	-	+					+	+	-	-	
JUANITA TRIB	C446	+		+	-	-	-	-			-	-	
JUANITY	446	+	-	+		-	-	-			-	-	-
KELSEY	444	+	-	+	-	-	-	-		-	-		-
KELSEY-WB	D444	+		+			-	-			+		
LEWIS	A617	T O O	F E W	D A T A									
LITTLE BEAR	478	+	-	+		+	-	-	+		+	-	-
LONGFELLOW	C370	-	+		-				+			+	
LYON	430		-	+	-	-	-	-					-
MAY	440	+		+	-		-	-		+	-	-	
McALEER	A432			+	-	+	-	-					
MILL	A315		+		-	-	-	-	-	-	-		-
NEWAUKUM AT 416TH	F322		-				-	-			-		-
NEWAUKUM MOUTH	322			+	-		-	+	+	-		-	-
NORTH	474	+		+	+		-	-	-	-	-	-	-
PINE LAKE CREEK	A680	T O O	F E W	D A T A									
PIPER	PIPER	T O O	F E W	D A T A									
SAMMAMISH - KENMORE	450	+	-	+		-	-	-	-	-	-	-	-
SAMMAMISH -MARYMOOR	486	+	-	+	-	-	-	-			-	-	
SOOS MOUTH	A320		-	+	-			-	+	+	+		
SOOS-COVINGTON	C320		-	+	-		-	-	+	-	+		+
SOOS-JENKINS	D320	+	-	+	-		-	-	+	+	+		-
SOOS-LITTLE SOOS	G320			+	-	-	-	-	-				-
SPRINGBROOK	317				-	-	-	-	-	-	-	+	-
SWAMP	470	+	-	+	-	-	-	-	-	+	-	-	-
THORNTON	0434	+	-	+	-	+		-	+	-		-	
TIBBETTS NEW	X630	T O O	F E W	D A T A									
TIBBETTS OLD	A630	T O O	F E W	D A T A									
VENEMA	VENEMA	T O O	F E W	D A T A									
YARROW	A499	+	-	+		+		-		+	+	+	

# Ambient Lake Monitoring

- ◆ 25 sites
- ◆ Sampled monthly (Oct – Feb)  
bi-monthly (Mar–Sept)
  - Bacteria
  - Temperature
  - Oxygen
  - pH
  - Nutrients
  - Chlorophyll
  - Transparency
  - Conductivity



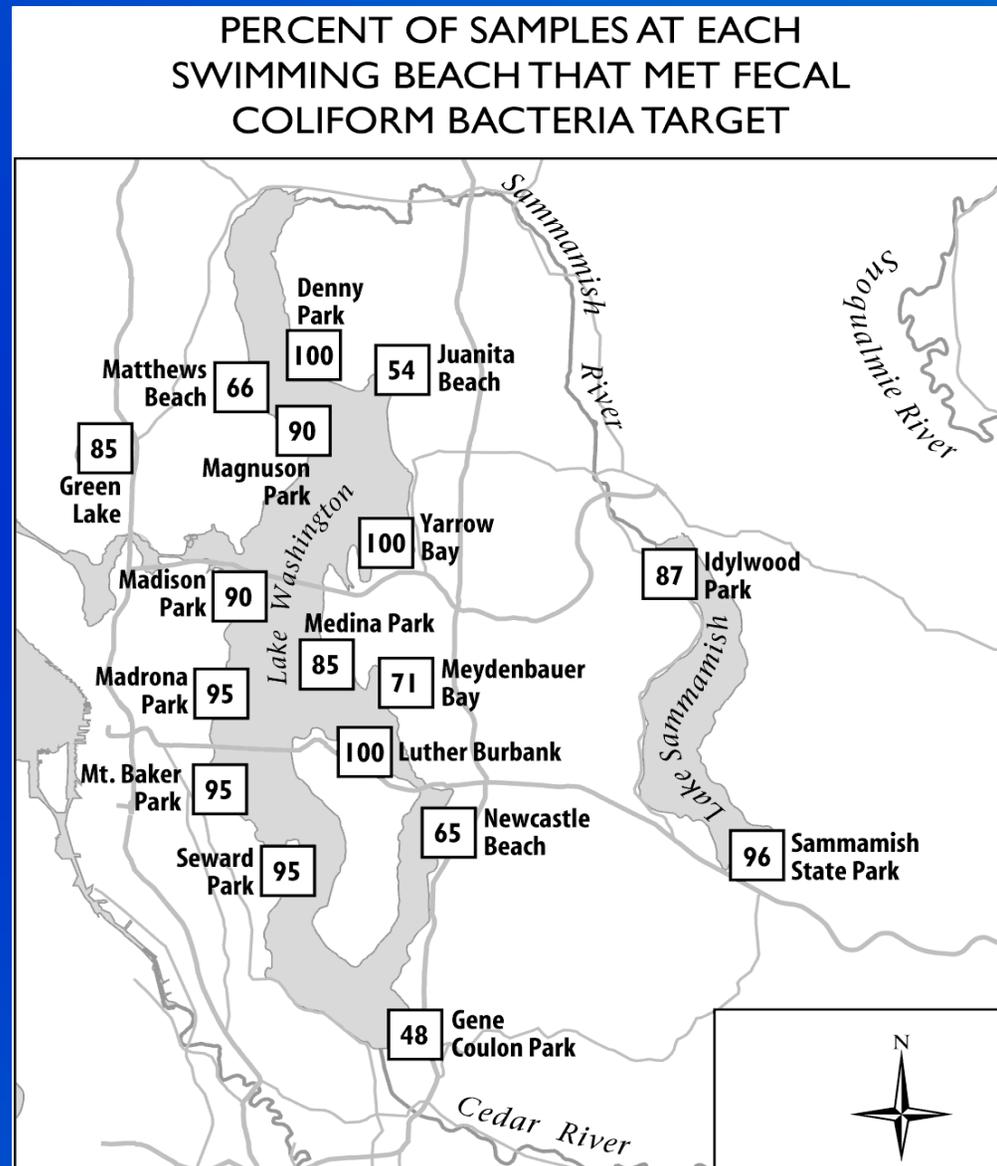
# Lake Trophic State Index (TSI)



TSI characterizes algal biomass based upon linear relationships for clarity (Secchi depth), total phosphorus, and chlorophyll *a*.

# 2004 Swimming Beach Monitoring

- ◆ Beaches sampled weekly during summer
- ◆ Coordinated effort between DNRP and SKCPH
- ◆ Cost-share with jurisdictions

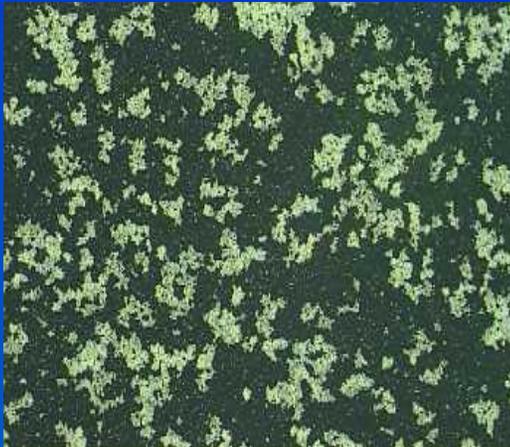


# 2004 Swimming Beach Closures

- ◆ Matthews Beach in early July
  - Stormflows from Thornton Creek
- ◆ Meydenbauer Bay Park from early July to mid-August
  - Leak in sewer line next to swimming beach
- ◆ Gene Coulon Beach in August and Sept
  - Possibly due to waterfowl?

# Toxic Cyanobacteria Monitoring

(toxic blue-green algae)



- ✦ King County monitored deep water stations for toxins 2003-2004
  - Monthly Oct – Feb
  - Bi-monthly Mar - Sept
- ✦ Tested for the presence of microcystins using several cellular extraction procedures
  - Sonication    – Freezing    - Refrigeration

# What are Cyanotoxins?

- ◆ Diverse range of chemicals
  - Hepatoxin – damage liver tissue
  - Neurotoxins – cause nerve damage
- ◆ Hepatoxins (microcystins) concern due to prevalence and potential harm to livestock and humans



# Are toxic algae a problem here?

- ✦ Cyanobacteria are present in most lakes

- ✦ Toxic blooms have been documented in Western Washington:

- American Lake (1989)
- Steilacoom Lake
- Green Lake (1997)
- Lake Sammamish (1997)



- ✦ Note: Not all cyanobacteria blooms produce toxins. What environmental factors lead to toxin production?

# Findings

## Toxic Cyanobacteria

### 2003 – 2004

- ✦ Analysis showed presence of microcystins at very low concentrations in all three lakes ( $< 0.35 \mu\text{g/L}$ )
  - Drinking water guideline =  $1.0 \mu\text{g/L}$   
(World Health Organization)
  - Recreational guideline =  $100 \mu\text{g/L}$
- ✦ 2005 cyanotoxicity sampling program modified to include nearshore and swimming beach areas



# Ambient Monitoring Information



- ◆ Lakes Monitoring website
  - <http://dnr.metrokc.gov/wlr/waterres/lakes/index.htm>
- ◆ Swimming Beach website
  - <http://dnr.metrokc.gov/wlr/waterres/lakes/bacteria.htm>
- ◆ Streams Monitoring website
  - <http://dnr.metrokc.gov/wlr/waterres/streams/creekindex.htm>