

Two Salt Spring lakes: enriched but completely different.



John B. Sprague

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St. Mary and Cusheon Lakes

Both:

- enriched
- cyanobacteria
- recent management plans



But

Physically direct opposites
Nutrient sources quite different

Moral:

Don't judge by lake's appearance
Don't guess on nutrient sources



St. Mary Lake





Physical

- “big” for Salt Spring
- 3 km long
- 13 times more volume than next lake

But

- drainage basin relatively small
- no. 3 for amount of inflow
- 95% replacement molecules = 15 years

St. Mary Lake

Nutrient status



Natural

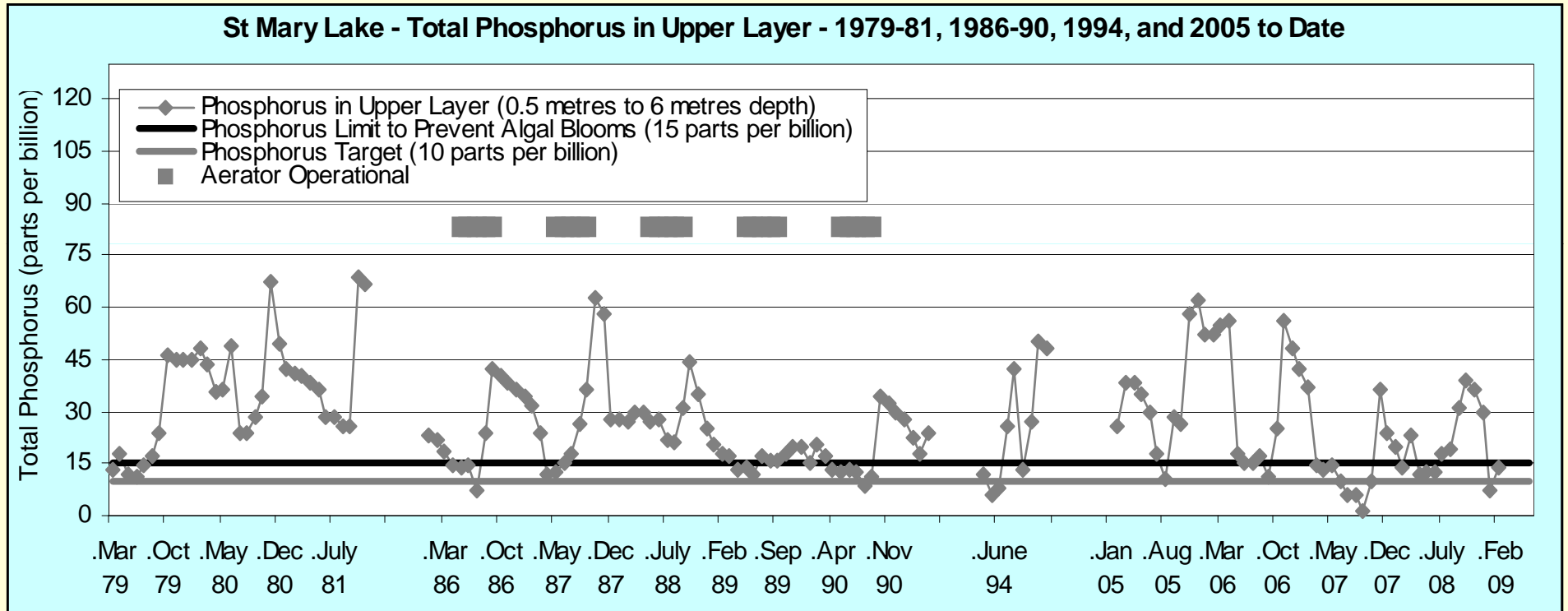
- middle eutrophy
- about 14.5 ppb of P

Today

- eutrophic
- > 20 ppb most of time
- always > 30 ppb after autumn mixing

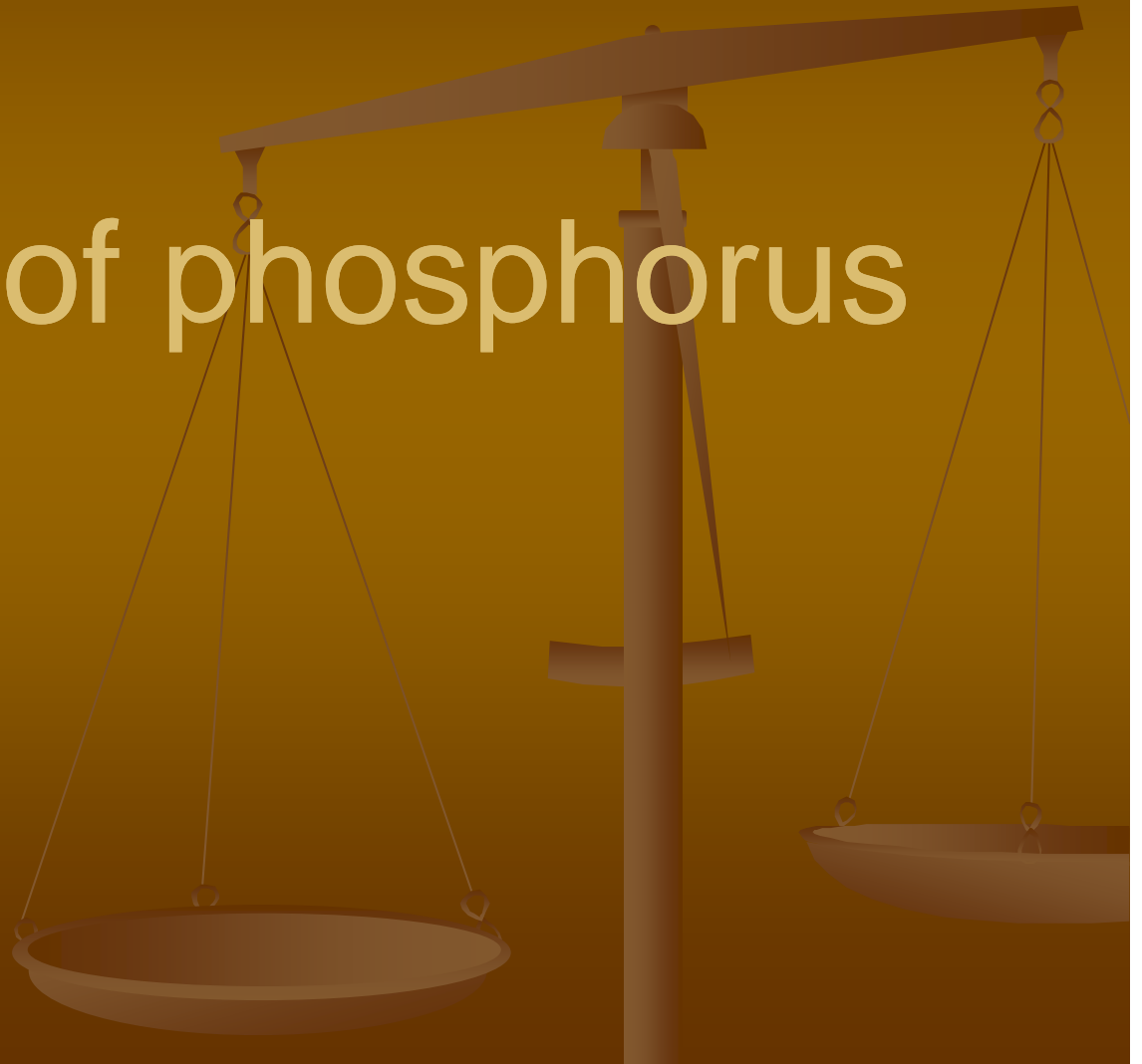
Total phosphorus, surface waters.

Starting 1979



Courtesy of Bob Watson, North Salt Spring Water District

Sources of phosphorus



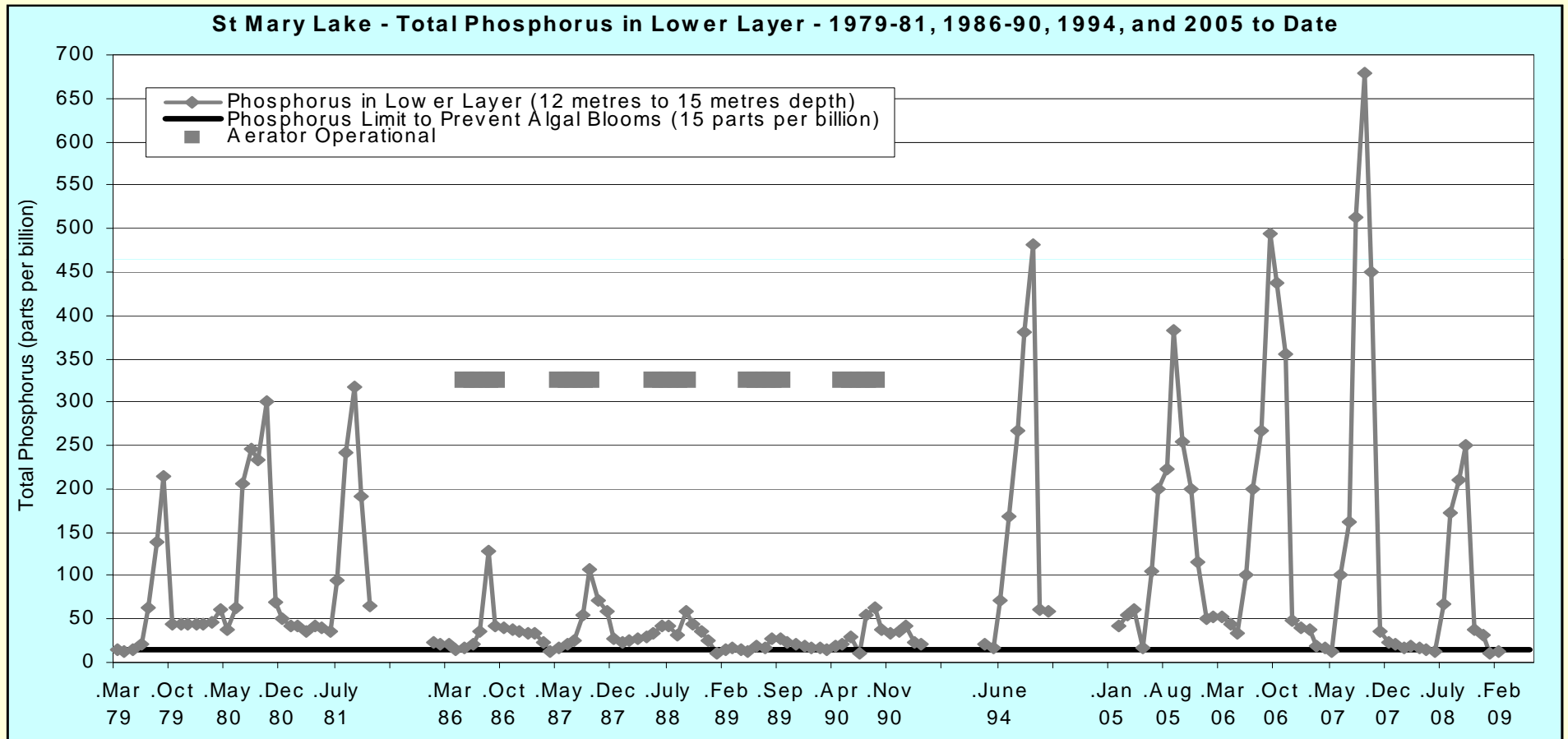
St. Mary Lake.

Yearly amounts of phosphorus in 1979-81.

Determined by Dr. Rick Nordin and co-workers.

Regeneration from sediment	625 kg	63%
Septic fields around lake	290 kg	29%
Land runoff via creeks	40 kg	4%
Rain and dustfall (JBS)	20 kg	2%
Groundwater input	10 kg	1%

Total P, deep water. Starting 1979



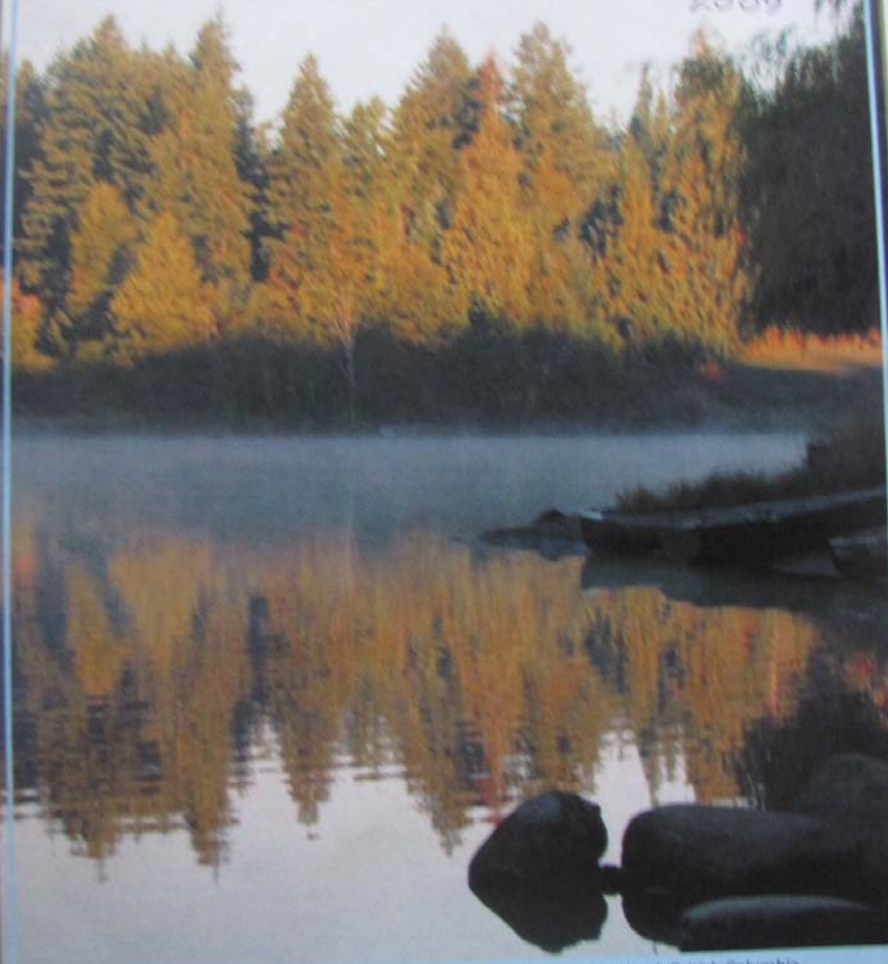
Courtesy of Bob Watson, North Salt Spring Water District

Aerators of deep water

- 5 years, 1986-1990
- moderately successful
- breakdown, funding disappeared

SPW 1113
SPECIAL REPORT
NOVEMBER 2008

ST. MARY LAKE WATERSHED MANAGEMENT PLAN 2009

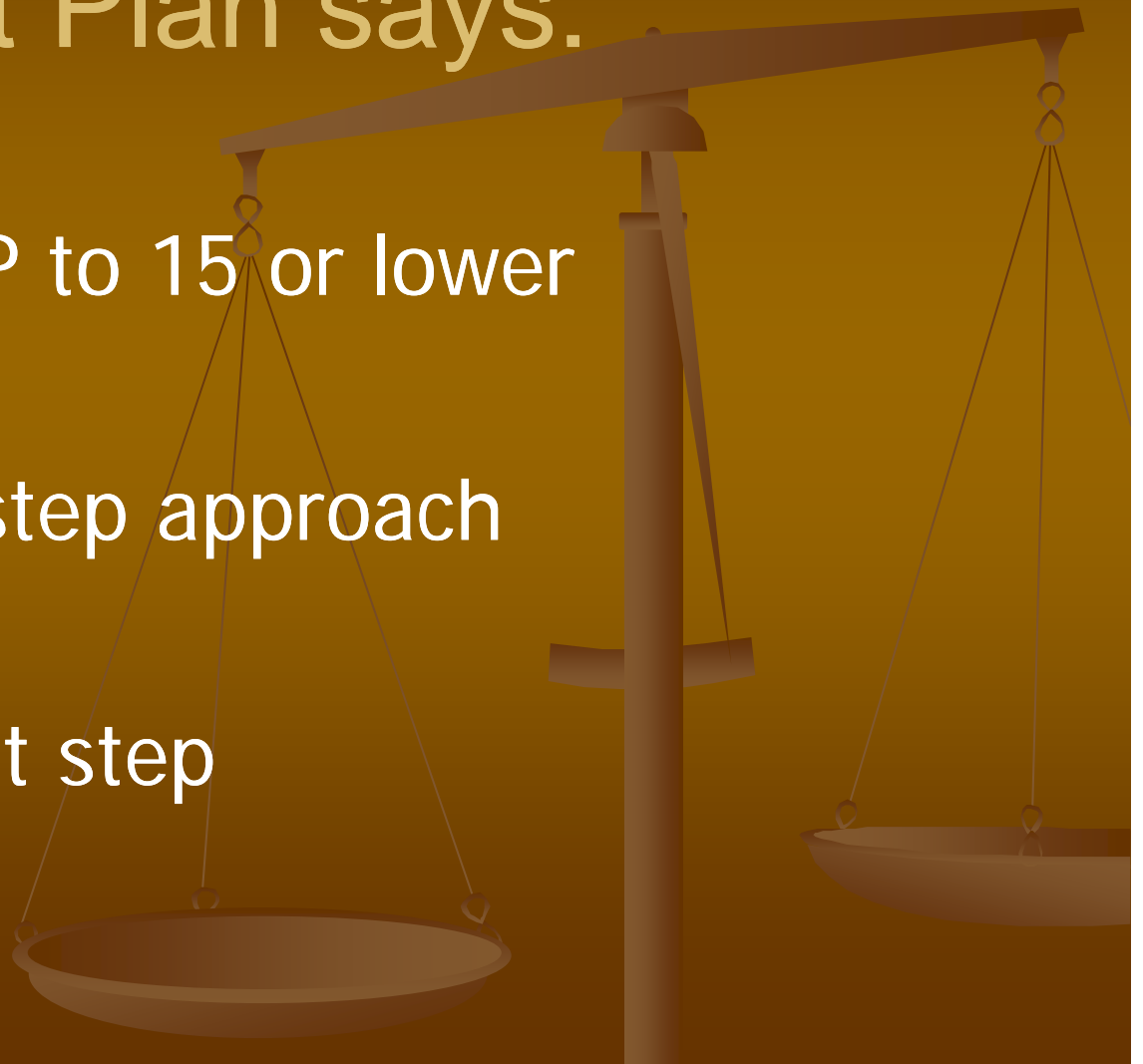


Prepared by the St. Mary Lake Steering Committee, Salt Spring Island, British Columbia

Photo: Michael Proulx

Management Plan says:

- Goal ... reduce P to 15 or lower
- take a step-by-step approach
- aerators first
- then decide next step



The aerators

Dr. Ken Ashley's talk today

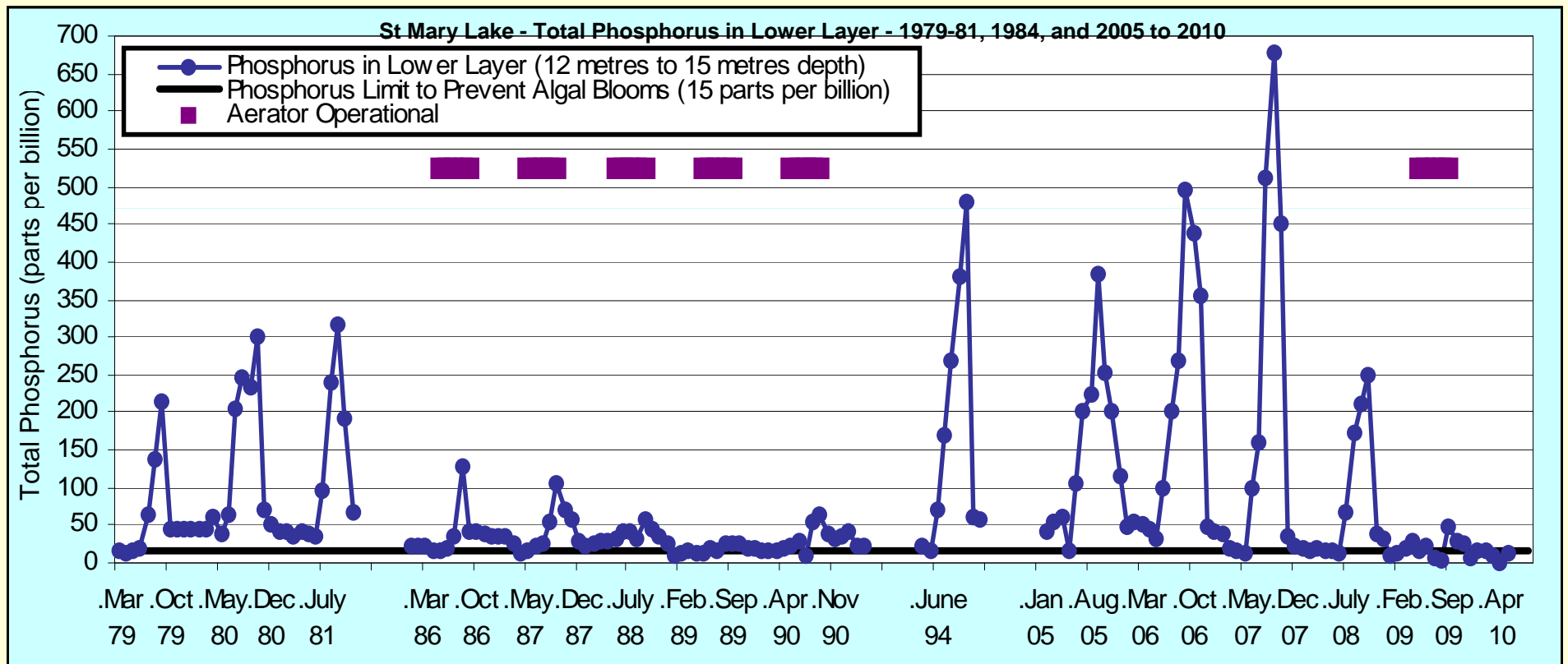
Installed autumn 2008







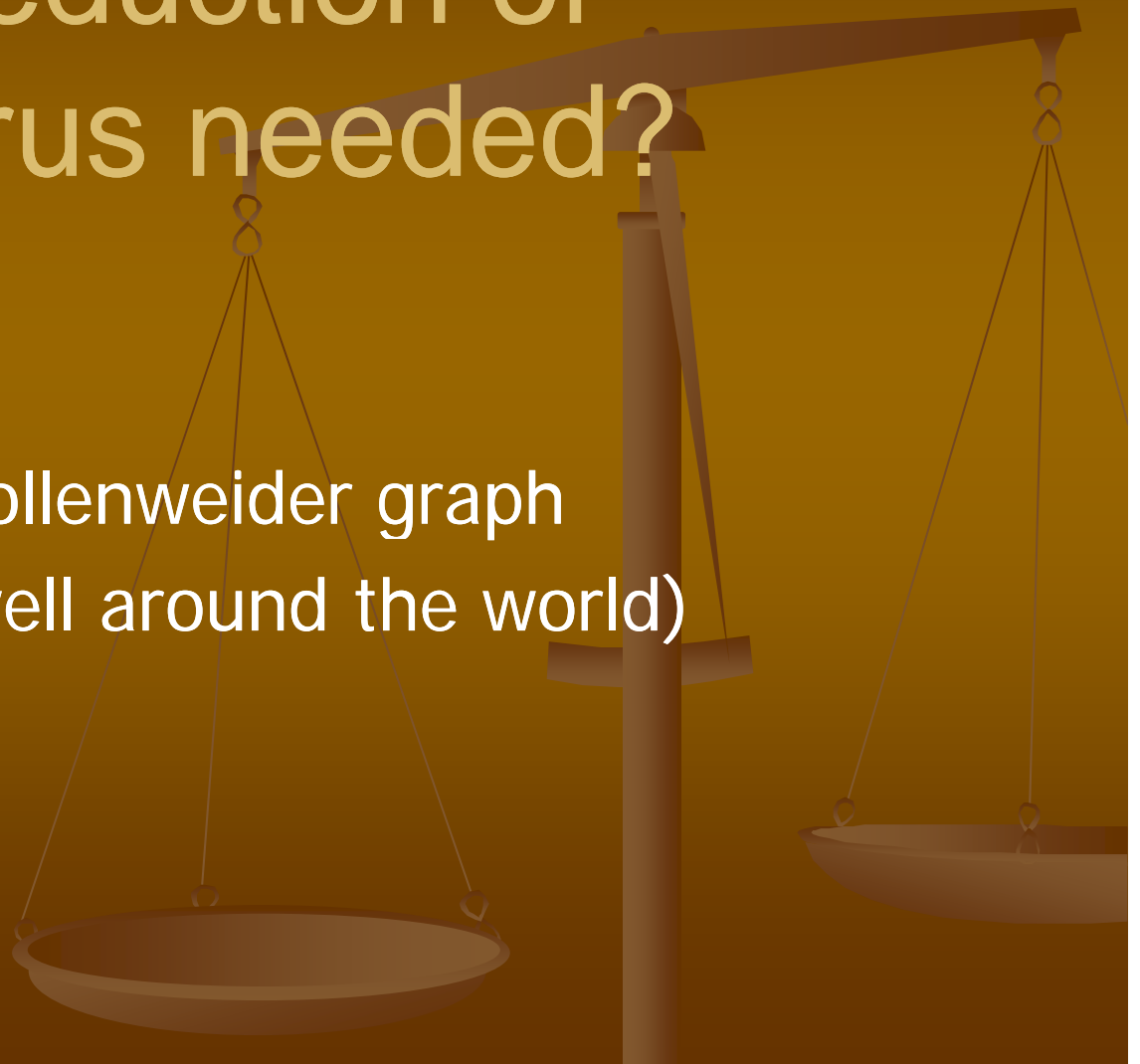
Deep-water P before and after aeration. To early 2010

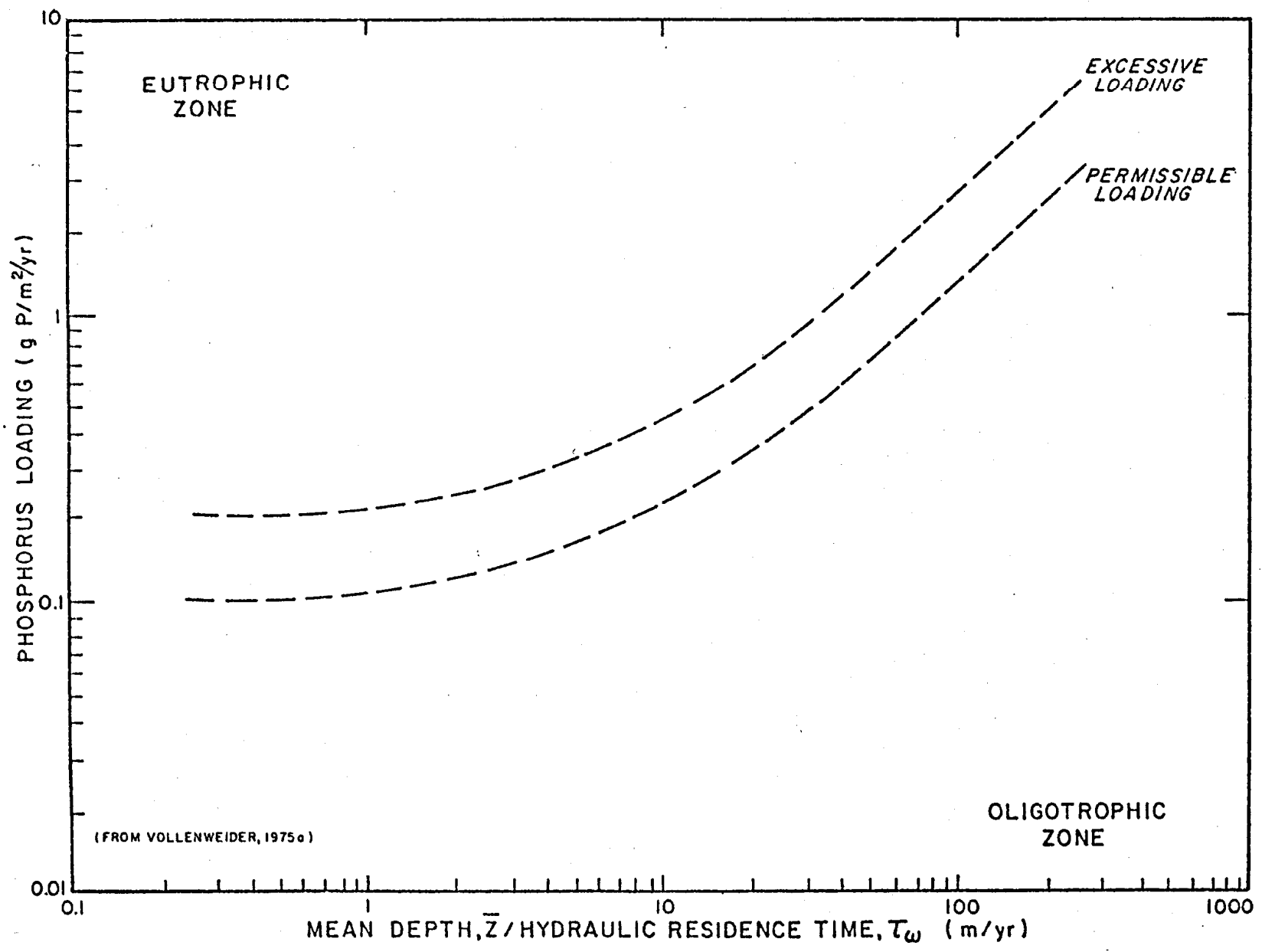


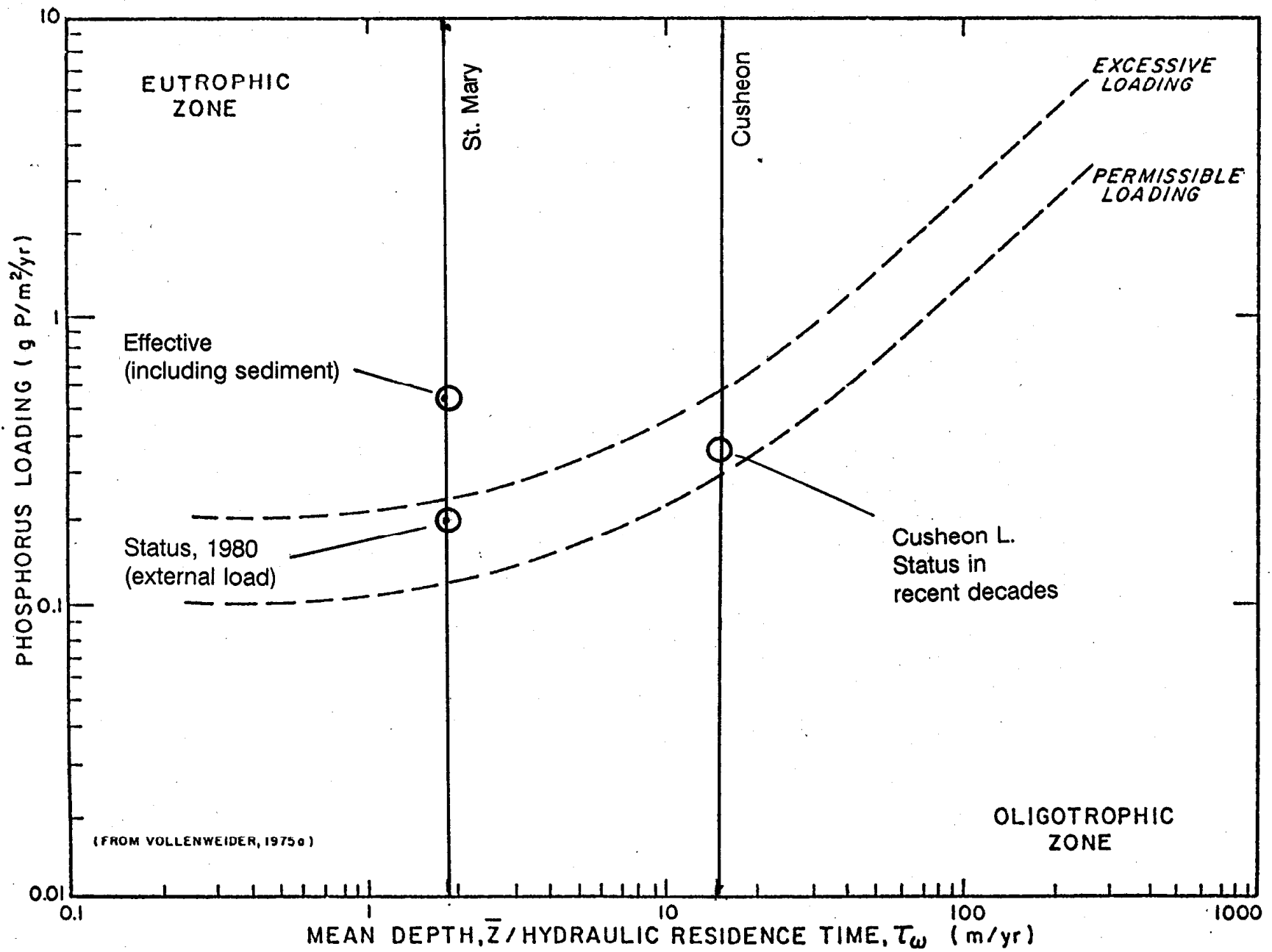
Courtesy of Bob Watson, North Salt Spring Water District

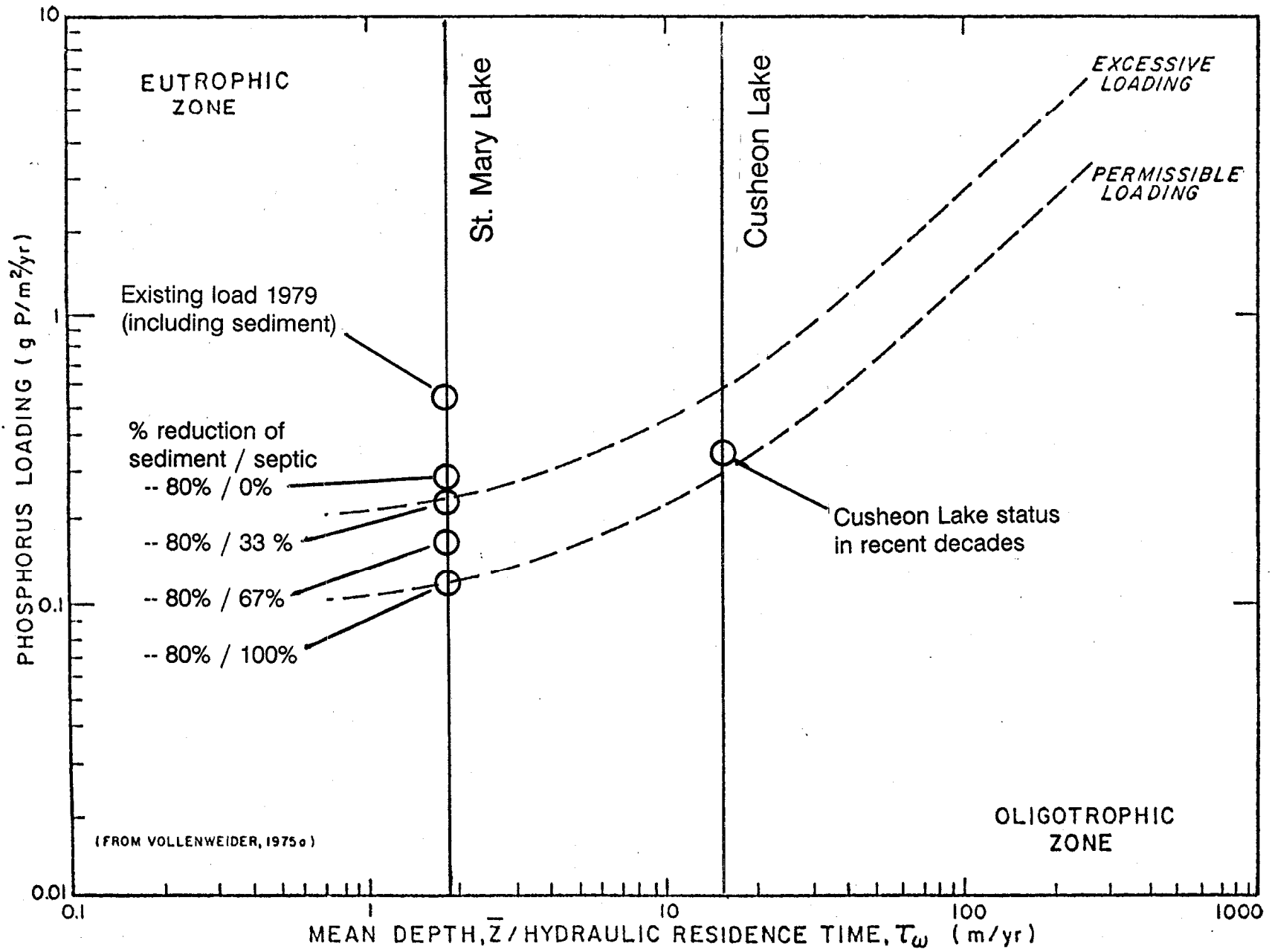
Further reduction of phosphorus needed?

Predictions by Vollenweider graph
(it works fairly well around the world)









Cusheon Lake





Physical:

Smaller, but lots of water

- 1.4 km long
- deepest hole = 9.1 metres
- last in chain of 3 lakes
 - ... so relatively large basin
- no. 1 lake for amount of inflow
- 95% replacement molecules = 11 months
(if we could even out seasonal rainfall)

Cusheon Lake

Nutrient status



Natural

- lower eutrophy
- about 13.5 ppb of P

Today

- high mesotrophic
- average 16.7 ppb, springtime & surface
- average 37 ppb just after autumn mixing

Sources of phosphorus



Quite different from St Mary Lake

Source of P	Estimated input	
	Kg P	%
Land runoff, upstream lakes	63	54
Residences near lake	27	23
Regeneration from sediments	25	21
Rain and fallout to surface	3	2
Total loading, kg P/year (totals may not add, from rounding)	117	100

Hard data on phosphorus
from Deb Epps
and Ministry of Environment

- Measured concentrations, surface water
- Increase in deep water during summer stratification

▪ Other inputs to lake had to be estimated :

- much combing of old reports
- “cottage-country” model of Dillon, Rigler, and Hutchinson
- check by one year of monitoring the flow and phosphorus in main creek
- considerable effort required
(personal challenge, like student assignments)

Items required:

- (1) Rainfall in watershed?
- (2) Evaporation?
- (3) Proportion of water that runs off land?
- (4) Amount of P in rain and fallout?
- (5) kg of P recycled from sediment?
- (6) Kg of P from septic fields?
- (7) kg of P carried off land, per hectare?

P runoff from land?

- trial-and-error modelling ...until ...
an assumed value predicted actual P
- each of two upper lakes (no shoreline houses).
- adopted average = 0.089 kg of P/hectare
- one year of creek monitoring ... similar = 0.11 kg/hectare (almost lost a volunteer)
- similar to 0.1 kg/ha, eastern forested land

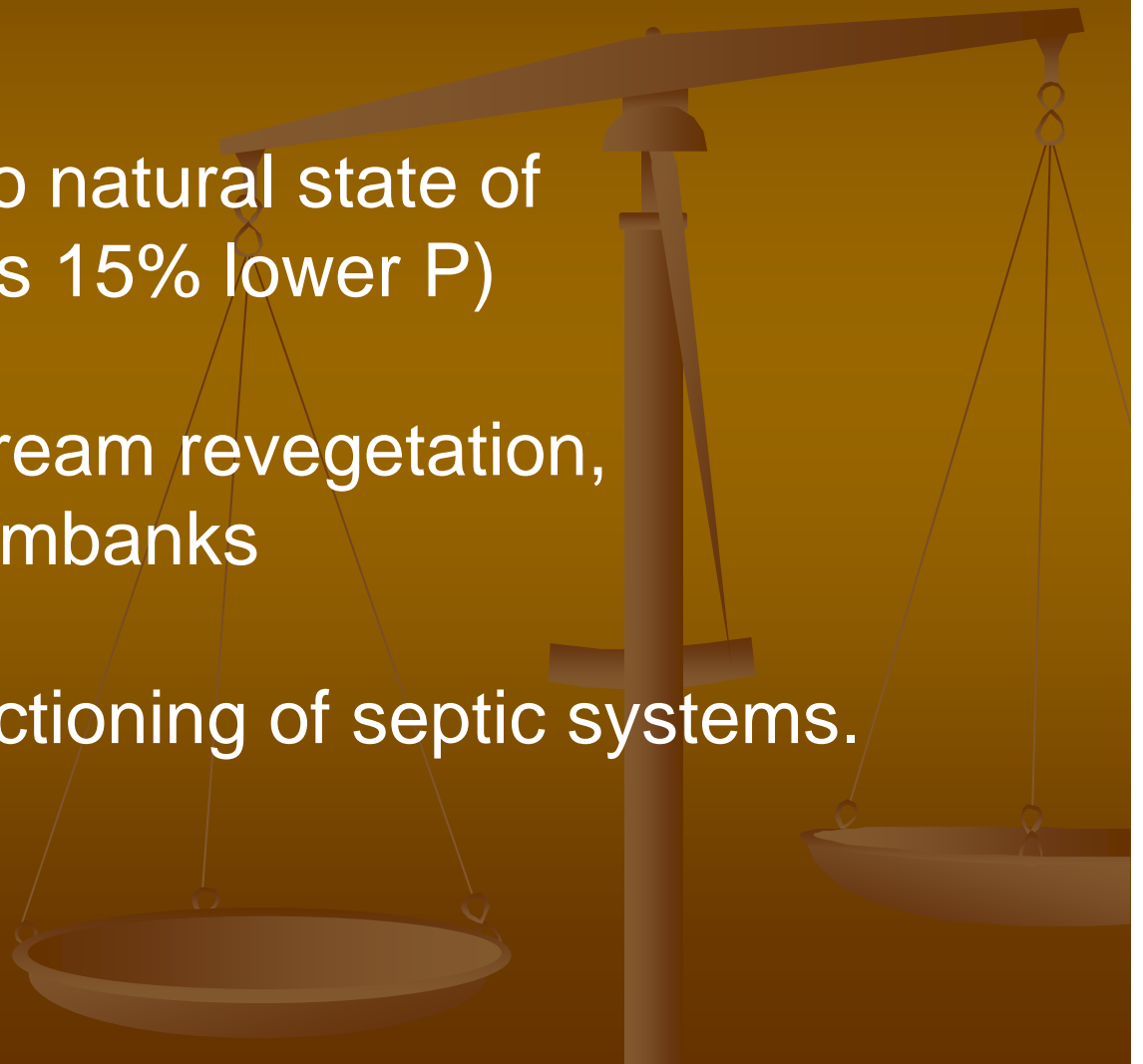
- Then a big model of 3-lake chain to predict:
 - input of P to Cusheon Lake
 - P concentration in lake.
- Surprised and gratified !!
model estimated almost exactly, for Cusheon:
 - amount of water outflow
 - average measured concentration

Plan recommendations

Goal: return lake to natural state of enrichment (needs 15% lower P)

Emphasis on upstream revegetation,
Especially of streambanks

Ensure proper functioning of septic systems.



Progress on the two lakes?

St Mary

- Immediate action on first phase
- Any further steps more difficult

Cusheon

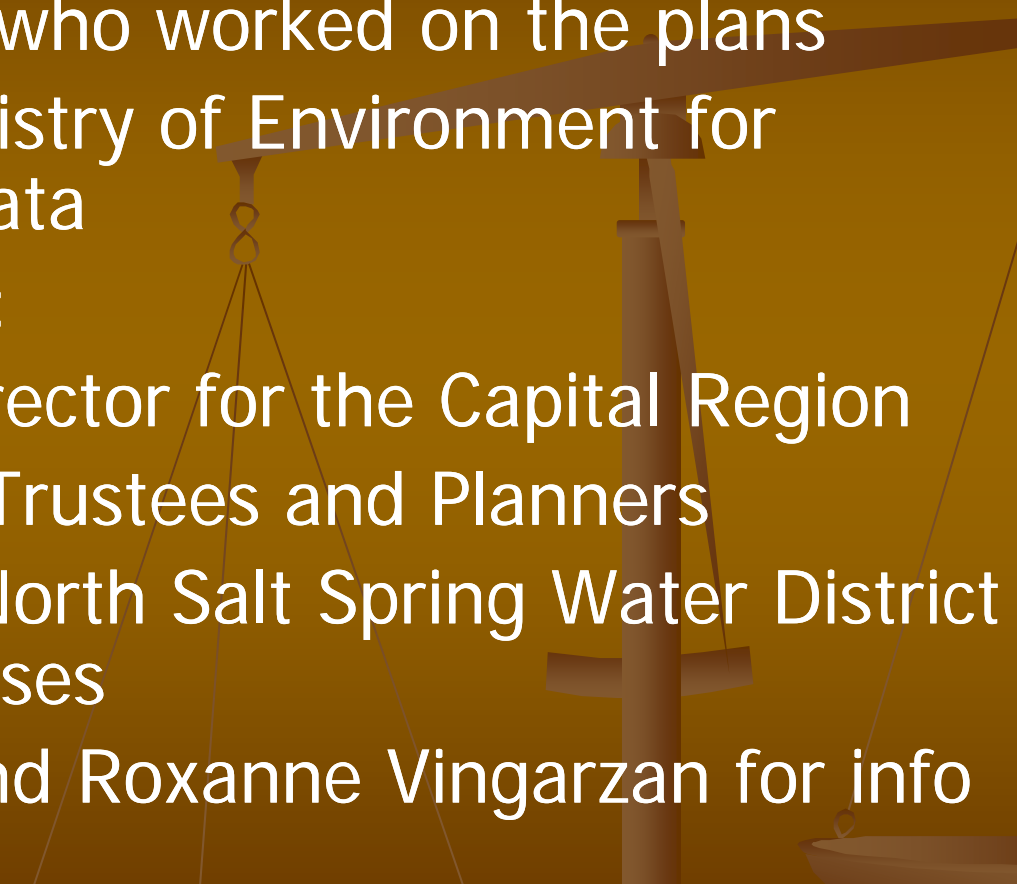
- No definite progress so far
- Stewardship Society has little leverage on upstream owners, for revegetation.
- Focussing on action by local government.



Finis



Acknowledgements

- All the volunteers who worked on the plans
 - Deb Epps and Ministry of Environment for information and data
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 - Islands Trust, Trustees and Planners
 - Bob Watson and North Salt Spring Water District for data and analyses
 - Drs Rick Nordin and Roxanne Vingarzan for info on rainout P
- 

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