Setting Phosphorus and Suspended Solids "Targets" for the Lower Fox River and Green Bay, Lake Michigan – Recent Advances

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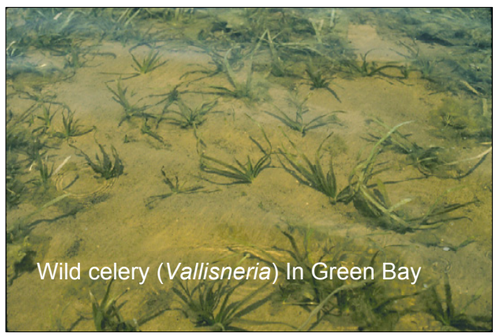
Chronological Listing of Groups, Management Plans, and Reports in Lower Green Bay

Year	Name of Group, Plan, Report or Program
1970-80's	UW Sea Grant, Green Bay Subprogram (Research and Outreach)
1978	The Wisconsin Nonpoint Source Water Pollution Abatement Program (WDNR)
1988	Green Bay Remedial Action Plan (RAP)
1990	State of the Bay Report 1990
1991	RAP Science and Technical Advisory Committee (STAC)
1992	Northeast Wisconsin Waters for Tomorrow (later became Fox-Wolf Watershed Alliance)
2003-07	Lower Fox River Watershed Monitoring Program
2004-07	SWAT Modeling for Load Allocation
2005	Toward a TMDL for P & TSS: Lower Fox River Basin
2007	State of the Bay Report 2008

Water Clarity Targets First Set By RAP

The 1988 Remedial Action Plan objectives for the lower Green Bay and Fox River Area of Concern include increased water clarity to support safe swimming (1.3 m average summer secchi depth) and underwater vegetation needed by fish and wildlife (minimum of 0.7 m average summer secchi depth). Water clarity (measured by the depth at which a secchi disk disappears from view) is related to the amount of total solids, volatile solids and algae (chlorophyll a) suspended in the water.
Secchi Disk = 0.80 - 0.174TSS - 0.17 VS - 0.16 Chla (r^2 = .69)



Predicted Total Suspended Solids (TSS) and Total Phosphorus (TP) in Area of Concern under Alternative TMDL Load Reduction Scenarios for the Fox River

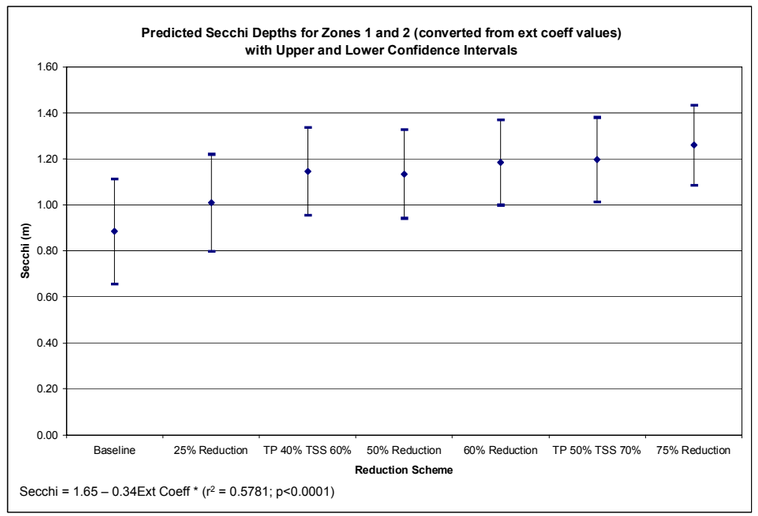
Variable	Baseline	25% Reduction	40% Reduction	50% Reduction	60% Reduction	75% Reduction
TSS (mg/l) River	40.6	30.5	24.4	20.3	16.2	10.1
TP (mg/l) River	0.20	0.150	0.120	0.100	0.080	0.05

Exercising Ext Coeff Model for Water Clarity

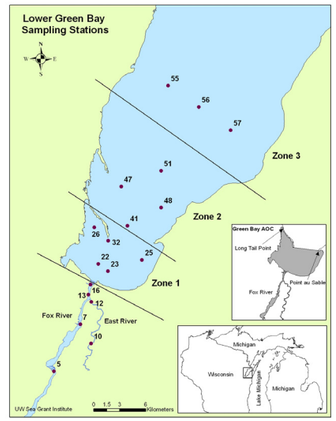
ExtCoeff $_{z1\&z2}$= 0.7758 + 2.8057*TP_R + 0.0225*TSS_R (r^2 = 0.35)

Variable	Baseline	25% Reduction	40% TP 60% TSS	50% Reduction	60% Reduction	75% Reduction
Ext Coeff	2.25	1.88	1.48	1.51	1.37	1.14

Relating Secchi Disk to Light Extinction in Zones 1 & 2



Secchi = 1.65 – 0.34Ext Coeff * (r^2 = 0.5781; p<0.0001)



- All stations sampled by Green Bay Metropolitan Sewerage District
- 12 stations sampled in 3 zones in lower Green Bay
- 4 stations sampled in Fox River

Relation of Water Clarity (Secchi depth) to Potential Increased Depth of Wild Celery (*Vallisneria*) Growth in Green Bay

Secchi Depth (m)	Estimated Maximum Depth of Colonization (Zc)
0.5	0.99
0.6	1.21
0.7	1.43
0.8	1.66
0.9	1.90
1.0	2.14
1.1	2.40
Values derived from McAllister 1991	

Zc values are 20% less than ZcLI values based on differences predicted by the model and depth of maximum colonization found in the field. Zc would be expected to be less than ZcLI values because the model predicts the maximum depth at which Vallisneria respiration is compensated by photosynthesis (ZcLI), not where it can grow and persist.

Vallisneria americana in Detroit River

(Schloesser and Manny 2007, JGLR 33: 8-19)

	1984	1996
Frequency of Occurrence	18	46
Mean Secchi (m)	0.8	1.2