Supplemental Material for Wang. Q., and Boegman, L. “Multi-Year Simulation of Western Lake Erie Hydrodynamics and Biogeochemistry to Evaluate Nutrient Management Scenarios”.

Table S1 Summary of Water Quality Data Sources for the Detroit River

Parameter	Estimation Method
Flow	Daily data obtained from Nanette Noorbakhsh (U.S. Army Corps of Engineers) (emails)
Temperature	Average of previous three-day air temperature
DO	100% Sat. O_2 Conc. = $14.59 - 0.3955\ T + 0.0072\ T^2 - 0.0000619\ T^3$
Si	Linear interpolated based on the data obtained from Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
NH_4	Linear interpolated based on the data obtained from U.S EPA STORET & Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
NO_2 & NO_3	Linear interpolated based on the data obtained from U.S EPA STORET & Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
PO_4	PO_4 = percentage of PO_4 (estimated based on Scavia_2014)*TP (TP loading=1080 MTA/year based on Dolan_2005)
PON	Linear interpolated based on the data obtained from U.S EPA STORET & Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
DON	Linear interpolated based on the data obtained from U.S EPA STORET & Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
POP	POP = 0.6(TP-PO_4)
DOP	DOP = 0.4(TP-PO_4)
POC	0.2 mg L^{-1} based on 2008 data from Dr. Leon Boegman
DOC	Linear interpolated based on the data obtained from Environmental Monitoring and Reporting Branch_Drinking Water Surveillance Program (emails)
Green	Multiplying the ratio of chlorophyte to TP concentration (Winter_2014) by TP concentration (dividing TP loads by flow rates)
Diatom	Multiplying the ratio of diatom to TP concentration (Winter_2014) by TP concentration (dividing TP loads by flow rates)
Cyanobacteria	Multiplying the ratio of cyanobacteria to TP concentration (Winter_2014) by TP concentration (dividing TP loads by flow rates)
Cryptophyte	Multiplying the ratio of cryptophyte to TP concentration (Winter_2014) by TP concentration (dividing TP loads by flow rates)

Table S2 Summary of Water Quality Data Sources for the Maumee River

Parameter	Estimation Method
Flow	Downloaded from Heidelberg college
Temperature	Average of previous three-day air temperature
DO	100% Sat. O_2 Conc. = $14.59 - 0.3955\ T + 0.0072\ T^2 - 0.0000619\ T^3$
Si	SiO_2 = 3.2 mg L^{-1} = 114 mmol/m^3 based on 2008 data from Bouffard et al (2013)
NH_4	NH_4 = 0.08*TKN (0.08 is obtained based on 2008 data from Bouffard et al (2013))
NO_2 & NO_3	Downloaded from Heidelberg college
PO_4	Downloaded from Heidelberg college
PON	PON = 0.25*TKN (0.25 is obtained based on 2008 data from Bouffard et al (2013)
DON	PON = 0.25*TKN (0.25 is obtained based on 2008 data from Bouffard et al (2013))
POP	POP = 0.6(TP-PO_4) [TP & PO_4 both downloaded from Heidelberg college]
DOP	DOP = 0.4(TP-PO_4) [TP & PO_4 both downloaded from Heidelberg college]
POC	POC = 0.5 mg L^{-1} based on 2008 data from Bouffard et al (2013)
DOC	DOC = 3 mg L^{-1} based on 2008 data from Bouffard et al (2013)
Green	Multiplying the ratios of chlorophyte to TP concentration (different ratio values for different months displayed in Bridgeman_2012) by TP concentration (Heidelberg college)

Diatom	Multiplying the ratios of daitom to TP concentration (different ratio values for different months displayed in Bridgeman_2012) by TP concentration (Heidelberg college)
Cyano-bacteria	Multiplying the ratios of cyanobacteria to TP concentration (different ratio values for different months displayed in Bridge-man_2012) by TP concentration (Heidelberg college)
Crypto-phyte	Multiplying the ratios of cryptophyte to TP concentration (different ratio values for different months displayed in Bridge-man_2012) by TP concentration (Heidelberg college)

Table S3 Description, default and assigned values of the parameters in GLM

Parameter	Description	Units	Default Value	Assigned Value	Calibration range
K_w	Extinction coefficient for PAR radiation	/m	0.9	0.76	0.6 – 1.0
C_h	Bulk aerodynamic coefficient for sensible heat transfer	–	0.0013	0.0013	0.00125 - 0.00135
C_e	Bulk aerodynamic coefficient for latent heat transfer	–	0.0013	0.0013	0.00125 - 0.00135
C_d	Bulk aerodynamic coefficient for momen-tum transfer	–	0.0013	0.0013	0.00125 - 0.00135
C_c	Mixing efficiency - convective overturn	–	0.125	0.125	-
C_w	Mixing efficiency - wind stirring	–	0.23	0.23	-
C_s	Mixing efficiency - shear production	–	0.2	0.2	-
C_t	Mixing efficiency - unsteady turbulence (acceleration)	–	0.51	0.51	-
C_{KH}	Mixing efficiency - Kelvin-Helmholtz turbulent billows	–	0.3	0.3	-
C_{hyp}	Mixing efficiency - hypolimnetic turbu-lence	–	0.5	0.5	-
wind_factor	Scaling factor that is used to multiply the wind speed data that is read in	–	1.0	0.9	1.0 – 0.8
lw_factor	Scaling factor that is used to multiply the longwave data that is read in	$mmol/m^3$	1.0	0.8	1.0 – 0.8
cloud_mode	Switch to configure the atmospheric longwave emissivity sub-model	$mmol/m^2$ /day	4	1	-

Table S4 Description, default and assigned values of the parameters in AED

Parameter	Description	Units	Default Value	Assigned Value	Calibration range
theta_sed_oxy	Temperature multiplier for temperature dependence of sediment oxygen flux	–	1.08	1.08	-
Ksed_oxy	Half saturation constant for oxygen dependence of sedi-ment oxygen flux	mmol/m^3	50	50	-
Fsed_oxy	Maximum flux of oxygen across the sediment water in-terface into the sediment	mmol/m2/day	-20	-20	-
theta_sed_frp	Temperature multiplier for temperature dependence of sediment phosphate flux	–	1.08	1.1	1.05 – 1.1
Ksed_frp	Half saturation constant for oxygen dependence of sedi-ment phosphate flux	mmol/m^3	50	50	40 - 60
Fsed_frp	Maximum flux of oxygen across the sediment water in-terface into the sediment	mmol/m^2/day	0.08	0.2	0.05 – 0.25
theta_sed_nit	Temperature multiplier for temperature dependence of sediment nitrate flux	–	1.08	1.08	-
Ksed_nit	Half saturation constant for oxygen dependence of sedi-ment nitrate flux	mmol/m^3	100	100	-
Fsed_nit	Maximum flux of nitrate across the sediment water in-terface into the sediment	mmol/m^2/day	-0.5	-0.5	-
Rdenit	Maximum rate of denitrifica-tion	/day	0.26	0.26	-
Kdenit	Half saturation constant for oxygen dependence of denitri-fication	mmol/m^3	2	2	-

theta_sed_doc	Temperature multiplier for temperature dependence of sediment DOC flux	–	1.08	1.08	-
theta_doc_miner	Temperature multiplier for temperature dependence of DOC mineralization rate	–	1.08	1.08	-
Ksed_doc	Half saturation constant for oxygen dependence of sediment DOC flux	mmol/m^3	4.5	4.5	-
Rdoc_miner	Maximum rate of mineralization of DOC	/day	0.001	0.001	-
Fsed_doc	Maximum flux of DOC across the sediment water interface into the sediment	mmol/m^2/day	10	10	-
theta_sed_amm	Temperature multiplier for temperature dependence of sediment ammonium flux	–	1.08	1.08	-
Ksed_amm	Half saturation constant for oxygen dependence of sediment ammonium flux	mmol/m^3	25	25	-
Fsed_amm	Maximum flux of ammonium across the sediment water interface into the sediment	mmol/m^2/day	3.5	3.5	-

Table S5 Description, default and assigned values of phytoplankton parameters in AED

Parameter	**Description**	**Units**	**GREEN**			**DIAT**			**CYANO**			**CRYPT**		
			Default Value	Assigned Value	Calibration range	Default Value	Assigned Value	Calibration range	Default Value	Assigned Value	Calibration range	Default Value	Assigned Value	Calibration range
P_{max}	Maximum phytoplankton growth rate of 20 ◦C	1/d	1.1	1.394	1.0–2.0	1.1	2.38	1.0–2.5	1.1	1.8	1.0–2.0	1.1	1.386	1.0–2.0
v_T	Arrhenius temp scaling coefficient for growth	-	1.05	1.05	1.0-1.2	1.05	1.04	1.0-1.2	1.05	1.048	1.0-1.2	1.05	1.05	1.0-1.2
T_{std}	Standard temperature	°C	15	20	15-22	15	7	5-9	15	21	19-22	15	18	15-20
T_{opt}	Optimum temperature	°C	24	24	22-27	24	9.8	9-15	24	25	23-30	24	21	21-23
T_{max}	Maximum temperature	°C	35	35	29-37	35	18.5	17-19	35	37	35-40	35	29	28-33
k_r	Phytoplankton respiration/metabolic loss rate of 20 ◦C	1/d	0.07	0.031	0.02-0.08	0.07	0.035	0.02-0.08	0.07	0.04	0.02-0.08	0.07	0.0285	0.02-0.08
v_r	Arrhenius temperature scaling for phytoplankton respiration	-	1.06	1.06	1.03-1.09	1.06	1.06	1.03-1.09	1.06	1.06	1.03-1.09	1.06	1.06	1.03-1.09

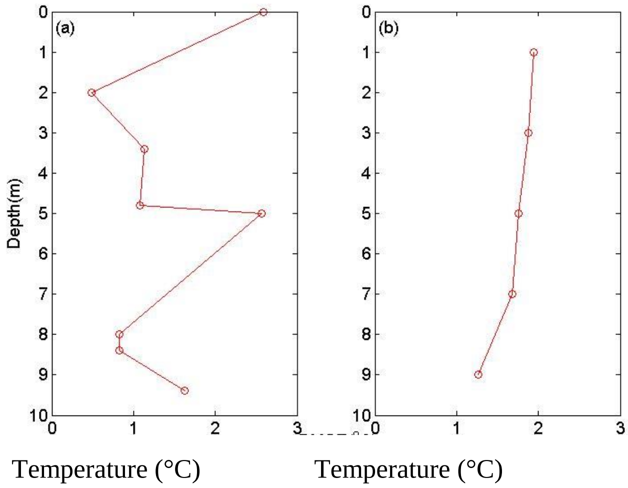

Figure S1 Calculated RMSE temperature at Sta. W1,2 for 1994 (a) and STN357 for 2008 (b), from time series shown in Figure 3.