Lac La Belle Tributaries Monitoring Report

Lake Grants LPL-698-00 and SPL-060-03

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Patrick Campfield
Water Resources Specialist
Wisconsin DNR

The Lac La Belle Management District of Waukesha County conducted tributary monitoring at 4 sites on the following dates:

06/11/2003
06/26/2003
09/15/2003
06/01/2004

Water samples were taken at the following sites:

Rosenow Creek
- Rosenow 1 – upstream, at the nature center (Parkview Dr.)
- Rosenow 2 – downstream, at the mouth of the creek (Beggs Isle Dr.)

La Belle Creek
- La Belle 1 – upstream of LLB Country Club (Lang Rd.)
- La Belle 2 – downstream, at the mouth of the creek (Lac La Belle Rd.)

The USGS also collected water samples on 6/10/03, 7/8/03, and 8/19/03 at the deepest point of Lac La Belle Lake.

Tributary samples were taken for the following variables:

1) Dissolved Nitrogen, NH_3 (Ammonia)

Ammonia nitrogen is released when organic matter decomposes in aquatic systems. Ammonia is quickly converted to nitrate if oxygen is present in water. Aquatic plants and algae can utilize ammonia, nitrate, and nitrite, which are all forms of inorganic nitrogen.

Sources: fertilizers from lawns and agricultural fields, human/animal wastes, septic systems, surface runoff, decay of organisms.

Lac La Belle is a phosphorus-limited lake. Phosphorus will impact green algae and aquatic plant growth. Changes in the amount of nitrogen present will not impact *green* algae or aquatic plant growth. However, high nitrogen levels can stimulate cyanobacteria blooms.

The EPA's recommended criterion for ammonia is $0.02 mg \bullet l^{-1}$ for freshwater aquatic life. During alkaline (high pH) conditions ammonium hydroxide (NH_4OH) occurs and can become toxic. Concentrations of 0.20 to $2.00 mg \bullet l^{-1}$ are lethal for fish.

2) Dissolved Orthophosphate, PO_4 (Ortho P)

Ortho P is soluble reactive phosphorus, dissolved in water and utilized by plants and algae for growth. The concentration of orthophosphate in a lake can change rapidly due to continuous uptake and release by plants. Ortho P is the only form of phosphorus assimilated by algae and plants for growth.

3) Total Phosphorus, TP

Total Phosphorus is the sum of Ortho P and particulate P, the phosphorus bound in plant and animal fragments suspended in water. Phosphorus naturally forms particles with calcium, iron, and aluminum, becoming insoluble (unusable by algae or plants).

Sources: human/animal wastes, soil erosion, detergents, septic systems, and runoff from farms and lawns.

Standards: $0.025 mg \bullet l^{-1}$ is the average for natural lakes
$0.065 mg \bullet l^{-1}$ is the average for impounded lakes
Oligotrophic Lakes have a TP range of 0.003 to $0.01 mg \bullet l^{-1}$
Mesotrophic Lakes have a TP range of 0.01 to $0.027 mg \bullet l^{-1}$
Eutrophic Lakes have a TP $\geq 0.03 mg \bullet l^{-1}$

4) Suspended Solids, SS

SS is a measure of the concentration of visible particulates suspended in water. Higher values indicate low visibility. Very turbid water can inhibit the feeding abilities of fish.

Standards: $<25 mg \bullet l^{-1}$ = Clear Water
$25\text{-}100 mg \bullet l^{-1}$ = Intermediate
$>100 mg \bullet l^{-1}$ = Muddy or Turbid
Healthy sport fisheries can be supported at $0\text{-}80 mg \bullet l^{-1}$

5) Turbidity

Turbidity is a measure of water transparency and also of mixing between water masses, expressed in nephelometric turbidity units (NTU). Turbidity is caused by suspended matter (clays, mud, algae, silica, and bacteria) in water.

Sources: precipitation, runoff, and subsequent increases in sediment input and riverflow. Turbidity levels can be elevated locally from carp feeding or spawning activity in nearshore shallow areas.

Standards: 50 NTU = turbid
>100 NTU = extremely turbid

Table 1. Nutrient and turbidity sample results for Lac La Belle tributaries, 2003-2004.

Location	Date	Ammonia N ($mg \cdot l^{-1}$)	Total P ($mg \cdot l^{-1}$)	dissolved P ($mg \cdot l^{-1}$)	suspended solids ($mg \cdot l^{-1}$)	turbidity (NTU)	precipitation history (48 hrs)
Rose1	06/11/2003	0.051	0.064	0.027	12	3.6	LOW
	06/26/2003	0.039	0.066	0.031	15	6.4	LOW
	09/15/2003	0.023	0.098	0.049	15	14.6	HIGH
	06/01/2004	0.039	0.083	0.042	9	8.2	HIGH
	Mean	**0.04**	**0.08**	**0.04**	**12.75**	**8.20**	
Rose2	06/11/2003	0.049	0.073	0.033	17	6.8	LOW
	06/26/2003	0.034	0.072	0.034	11	5.7	LOW
	09/15/2003	ND	0.082	0.040	19	13.6	HIGH
	06/01/2004	0.051	0.104	ND	16	11.0	HIGH
	Mean	**0.04**	**0.08**	**0.04**	**15.75**	**9.28**	
Lac1	06/11/2003	0.115	0.187	0.800	25	ND	LOW
	06/26/2003	0.086	0.158	0.024	53	24.6	LOW
	09/15/2003	0.040	0.135	0.019	52	23.4	HIGH
	06/01/2004	0.182	0.204	0.083	32	8.7	HIGH
	Mean	**0.11**	**0.17**	**0.23**	**40.50**	**18.90**	
Lac2	06/11/2003	0.111	0.316	0.043	ND	24.1	LOW
	06/26/2003	0.220	0.199	0.050	61	27.5	LOW
	09/15/2003	0.094	0.522	0.060	120	40.8	HIGH
	06/01/2004	0.111	0.137	0.070	7	7.0	HIGH
	Mean	**0.13**	**0.29**	**0.06**	**62.67**	**24.85**	

ND = None Detected

Summary

Ammonia, NH_3: Values in Rosenow Creek ranged from ND to 0.051mg•l^{-1}. Values in La Belle Creek ranged from 0.040 to 0.220mg•l^{-1}. Baseline monitoring in Waukesha County lakes has found NH_3 values ranging from 0.017 to 0.053mg•l^{-1}. These measurements indicate nitrogen loading from La Belle Creek into Lac La Belle Lake in the form of ammonia nitrogen. The effect is likely local. Values in the lake proper (0.036mg•l^{-1}) are within the range for Waukesha County lakes.

Total Phosphorus, TP: Values in Lac La Belle Lake ranged from 0.015 to 0.078mg•l^{-1}. Measurements in Rosenow Creek ranged from 0.064 to 0.104mg•l^{-1}. Values in La Belle Creek ranged from 0.135 to 0.522mg•l^{-1}. Values in Lac La Belle Lake indicate mesotrophic to eutrophic conditions. A lake is considered eutrophic if total phosphorus values exceed 0.030mg•l^{-1}. Samples from Rosenow and La Belle Creeks indicate a eutrophic to hyper-eutrophic condition. Both tributaries serve as sources of phosphorus loading to Lac La Belle. These inputs may affect the entire lake, as total phosphorus values for Lac La Belle Lake are relatively high.

Dissolved Orthophosphate, PO_4: Values in Rosenow Creek ranged from ND to 0.049mg•l^{-1}. Values in La Belle Creek ranged from 0.019 to 0.800mg•l^{-1}. Both tributaries contain much higher levels of Ortho P than LacLaBelle Lake (0.003mg•l^{-1}), suggesting the impacts of tributary effluents are only local.

Suspended solids: Values in Rosenow Creek ranged from 9 to 19mg•l^{-1}. Values in La Belle Creek ranged from ND to 120mg•l^{-1}. The standard for clear water (<25mg•l^{-1}) is met in Rosenow Creek, but La Belle Creek is moderately turbid.

Turbidity: Rosenow Creek measurements ranged from 3.6 to 14.6 NTU. Values in La Belle Creek ranged from ND to 40.8 NTU. Again, Rosenow Creek is very clear while La Belle Creek is relatively turbid.

Conclusions

The values for NH_3, Ortho P, and TP indicate that La Belle Creek is responsible for more of the nutrient input to the lake when comparing the two tributaries. For all of the nutrient and turbidity variables, La Belle Creek values were 2-3 fold higher than those in Rosenow Creek.

Localized (NH_3, Ortho P) and dispersive (TP) nutrient loading into Lac La Belle Lake occurs via La Belle Creek. The data indicate that Rosenow Creek impacts nutrient loading to Lac La Belle Lake much less than La Belle Creek. This is true for each form of nitrogen and phosphorus measured. A distinct difference also is observed in turbidity measurements between tributaries, with La Belle Creek consistently showing higher turbidity than Rosenow Creek.

The two tributaries also differ when comparing upstream and downstream sites. Mean values for each variable are similar between the upstream and downstream sites of Rosenow Creek. In La Belle Creek, mean values were noticeably higher downstream for Total P and both measures of turbidity. Ortho P values were four times higher upstream in La Belle Creek.