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Abel Lake Water Quality: Trends over four decades

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Introduction

- Located in Stafford County, VA
- Previously active water source, treatment facility ran 1983 – 1999
- Raw water monitored continuously at plant intake while operating
- Additional water quality data available from a 1988 study

Historic Trends

- pH values greater than 7 due to summer photosynthesis of consumption of CO₂
- Turbidity curves due to suspended sediment and higher algae contents
- Color changes due to high leaf litter decomposition in fall months
- Iron and Manganese are fluctuating with seasonal temperatures due to amounts of rain fall and leeching
- Hardness changes due to the amounts of dissolved cations present in the lake that also rise in the fall

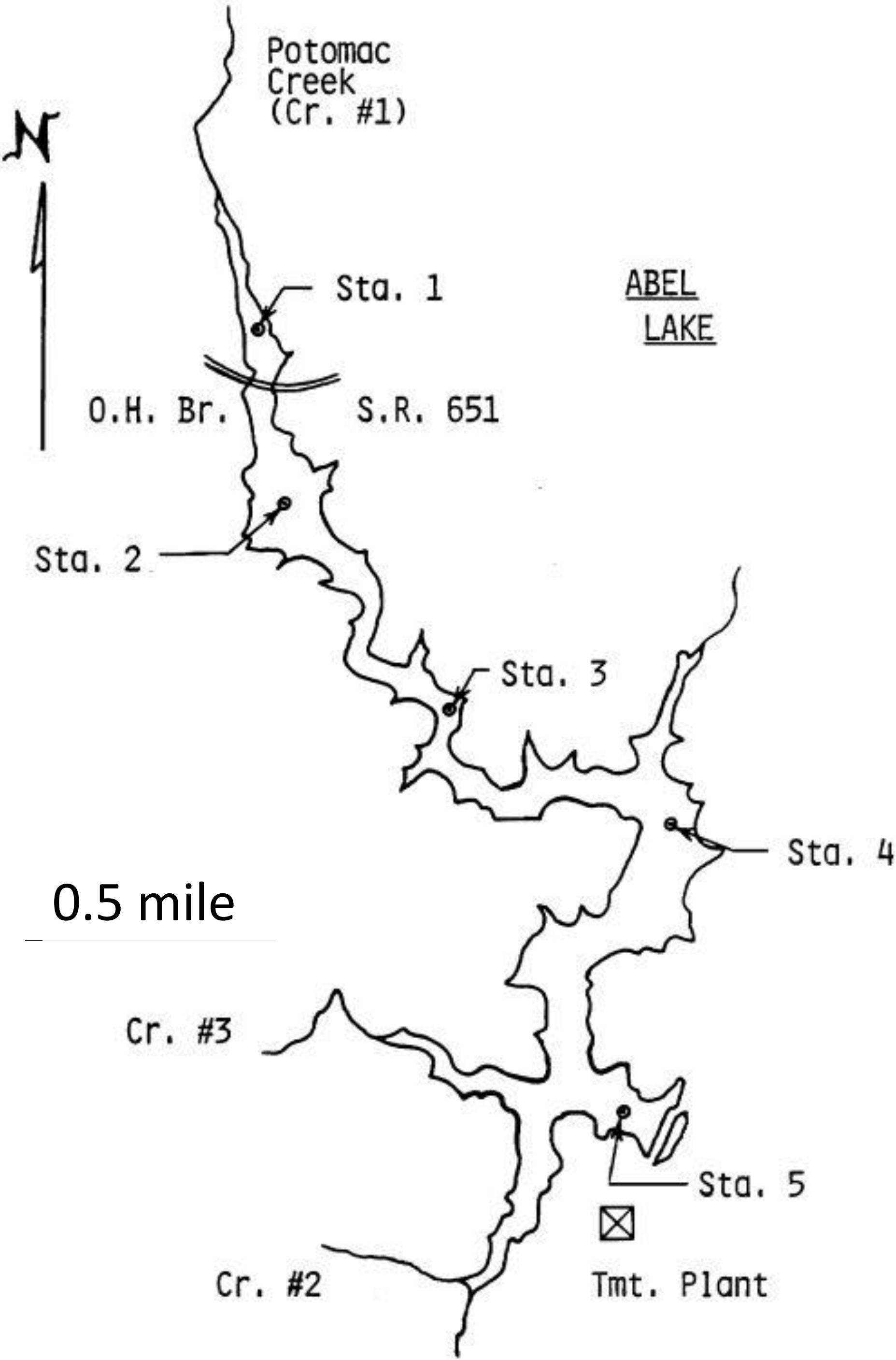
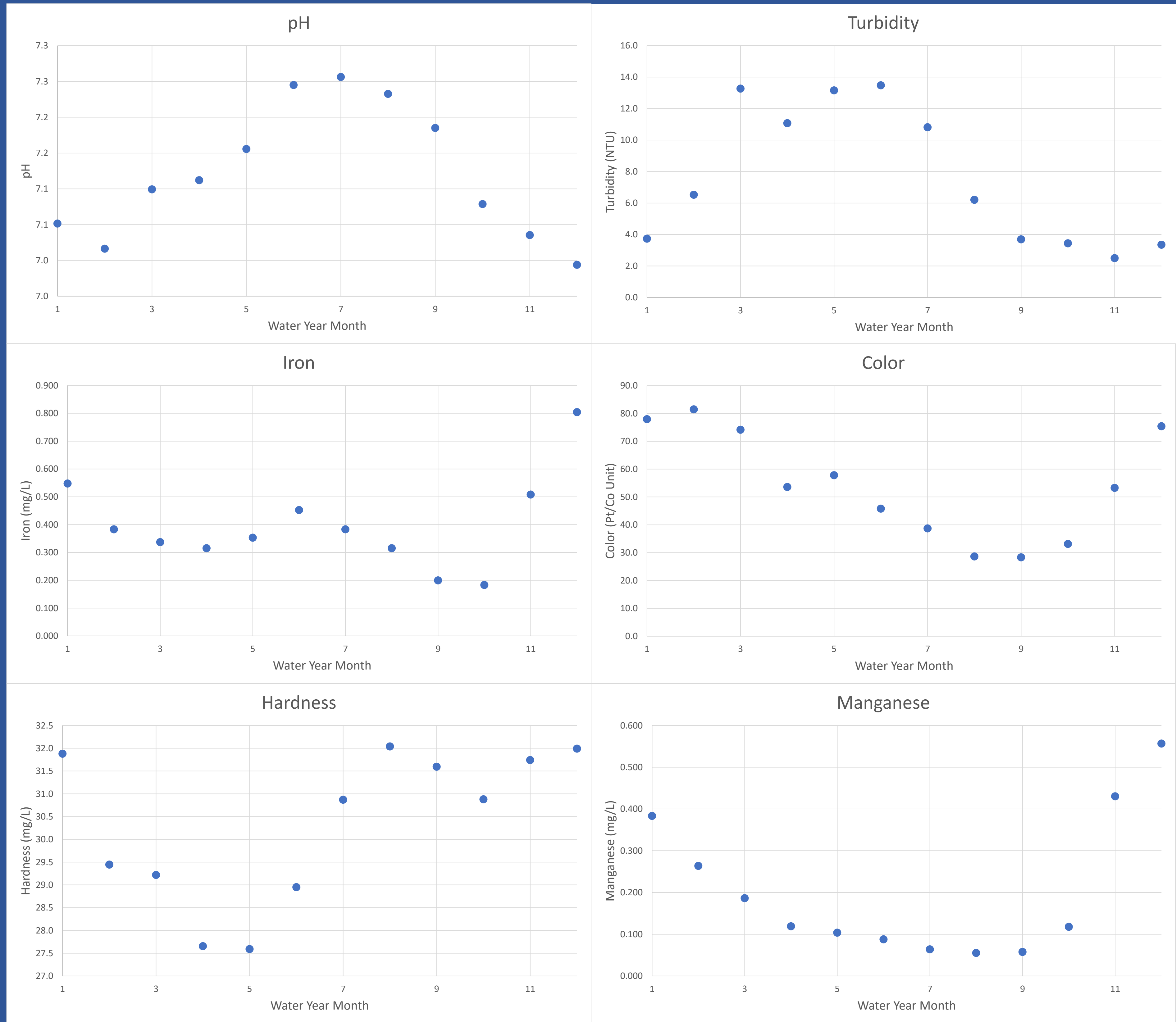
New Observed Trends

- Alkalinity levels have increased by 2.5%
- pH increases through lake from sites 1 – 5, consistent with eutrophication
- NO3-N decreased through lake from sites 1 – 5, suggesting algae uptake
- T-PO4 levels are now under range

Water Quality Points of Interest

- | | |
|--------------|-----------|
| ➤ pH | Turbidity |
| ➤ Iron | Color |
| ➤ Hardness | Manganese |
| ➤ Alkalinity | Nitrate |
| ➤ Phosphorus | Ammonia |
| ➤ Chloride | Cadmium |

Abel Lake is a vital
emergency water resource
that should be properly
taken care of for possible
future needs



Reasons for Quality Changes

- Seasonal shifts
- Environmental impacts
- Amount of recreation
- Vegetation numbers
- Human impact
- Agriculture
- Development

Table 1: Water quality data across 5 Abel Lake sampling sites collected in 1985 and in 2022										
Sample Site	1985					2022				
	1	2	3	4	5	1	2	3	4	5
Alkalinity (mg/L CCE)	25.8	28.4	24.6	24.4	27.8	62.7	51.1	43.7	40.1	38.7
Hardness (mg/L CCE)	33.4	34.4	31.8	31.6	31.8	31.8	31	33.9	30	36.6
Chlorophyll-a (ug/L)	6.6	8.5	4.77	3.25	1.825	*	*	*	*	*
Cl- (mg/L)	4.24	4.05	4.08	4.12	3.85	9.2	9.28	9.29	11.5	10.81
Conductivity (umohs/cm)	78	98	85	92	86	*	*	*	*	*
Fe (mg/L)	0.424	0.23	0.302	0.26	0.156	*	*	*	*	*
Min (mg/L)	0.032	0.01	0.042	0.042	0.014	*	*	*	*	*
Cadmium (mg/L)	*	*	*	*	*	BD	*	*	*	BD
TKN (mg/L)	0.28	0.3275	0.27	0.177	0.2675	*	*	*	*	*
Ammonia - N (mg/L)	*	*	*	*	*	0.162	0.07	0.07	BD	0.028
NO2- (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	*	*	*	*	*
NO3- N (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	0.64	0.49	0.46	0.36	0.34
O-PO4 (ug/L)	<0.5	<0.5	<0.5	<0.5	<0.5	*	*	*	*	*
T-PO4 (ug/L)	46.25	38	42.67	39.67	34.375	BD	BD	BD	BD	BD
ORP/Eh (mv)	*	*	*	*	*	173	183	189	189	190
pH	7.02	7.18	7.24	7.3	7.2	7.18	7.31	7.26	7.47	7.54
Secchi Disk (in)	47.2	74.4	83.2	90	113.75	*	*	*	*	*
SO4- (mg/L)	6.36	5.825	6.6	6.5	6.25	*	*	*	*	*
TOC (mg/L)	6.2	4.58	6.38	5.95	3.98	*	*	*	*	*
Apparent color	32.75	29.4	25.75	21.75	23.8	*	*	*	*	*
True color	44.6	17.8	43.4	33.4	16.6	*	*	*	*	*

Future Concerns

- The introduction of new development such a golf course surrounding the lake would be catastrophic to its safety consumption standards by the influences of fertilizers and lack of forested vegetation protecting the lake body from possible toxins by plant absorption