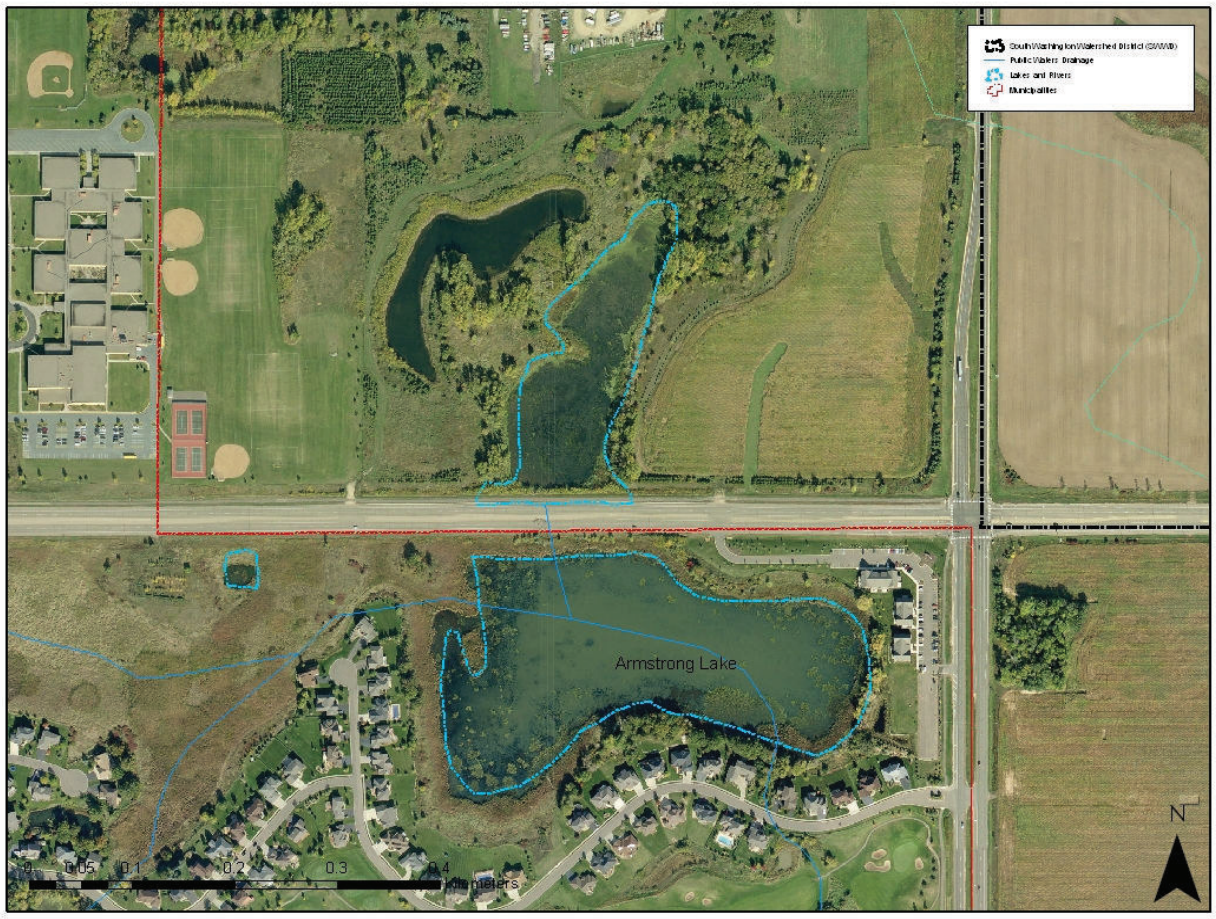
Armstrong Lake

DNR ID #82-0116 Municipality: Lake Elmo/Oakdale
Surface Area: 39 Acres Watershed Area: 566 Acres
Mean Depth: 3-5 feet Maximum Depth: 5 feet
SWWD Maximum Allowable Phosphorus Load: 0.18 lbs/ac/yr
SWWD Trophic State Index (TSI) goal: 63-66

Map 12: Armstrong Lake



Armstrong Lake (Map 12) is approximately 39 acres in size and has a contributing watershed of 487 acres. This very shallow and flat lake is located in the headwaters of the Northern subwatershed. A majority of the drainage area to the lake is from Oakdale and is comprised mostly of low density residential land use with some farm areas; few undeveloped parcels remain. The lake is used for wildlife viewing and aesthetics. Non-motorized boating is possible.

The lake is divided in two by County Road 10 with a culvert under the road connecting the north and south basins. The northern portion of the lake is in Lake Elmo and has a maximum depth of 3 feet. The southern portion of the lake is in Oakdale and has a maximum depth of 5 feet. Water quality samples are taken in the southern basin because of its greater depth.

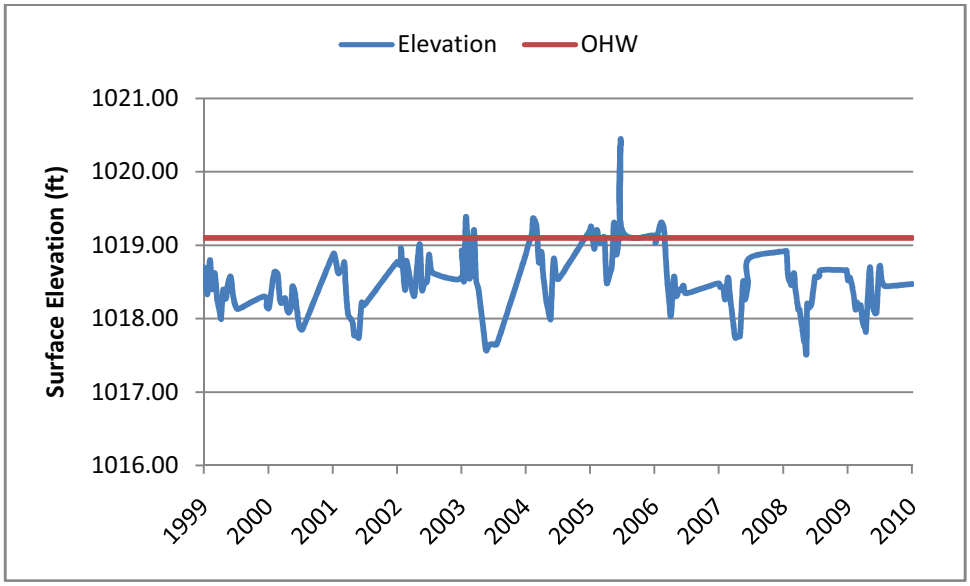
SWWD sets an interim TSI goal of 63-66 for Armstrong Lake, corresponding to an allowable watershed TP loading rate of 0.18 lbs/ac/yr. SWWD's interim goal exceeds MnPCA eutrophication standards. Upon meeting SWWD's interim goal, loading rates will be reevaluated and modified to work toward meeting state eutrophication standards.

Results

Lake level has been recorded by volunteers at Armstrong Lake since 1999. Armstrong Lake fluctuates quickly, but only within a small range of elevations. The surface elevation of Armstrong Lake has not exceeded the ordinary high water elevation since 2006. Recorded surface elevations are presented in Figure 13.

Lake water quality was monitored monthly through the growing season. Water Quality results are below in Table . Annual growing season averages of total phosphorus, chlorophyll a, and secchi transparency are shown graphically in Figures 14-16. Armstrong Lake's 2010 trophic status and historical lake grades are presented in Table 16.

Figure 13: Armstrong Lake Surface Elevation, 1999-2010



Date	Secchi Depth (m)	Water Temperature C	Surface Elevation	Pheophytin-a corrected Chlorophyll-a (ug/L)	Trichromatic Chlorophyll-a (ug/L)	TKN (mg/L)	TP (mg/L)
5/2/2010	1.1	12.6	1018.37	2.3	2.3	0.84	0.032
5/30/2010	1.1	27	1018.41	3.8	5.9	0.81	0.076
6/27/2010	1.2	27	1018.75	2.3	3.2	0.82	0.03
7/25/2010	0.08	27.4	1018.47	11	14	0.55	0.051
8/17/2010	1.2	23.3	1018.77	5.2	5.9	0.84	0.104
9/19/2010	1.1	13.4	1018.57	9.6	11	0.84	0.038
10/15/2010	1	14.6	1018.49	13	15	0.99	0.079

Table 16: Armstrong Lake 2010 Water Quality Results From the Met Council Citizen Assisted Monitoring Program (CAMP)

Figure 14: Armstrong Lake Historical Mean Growing Season Total Phosphorus Concentrations

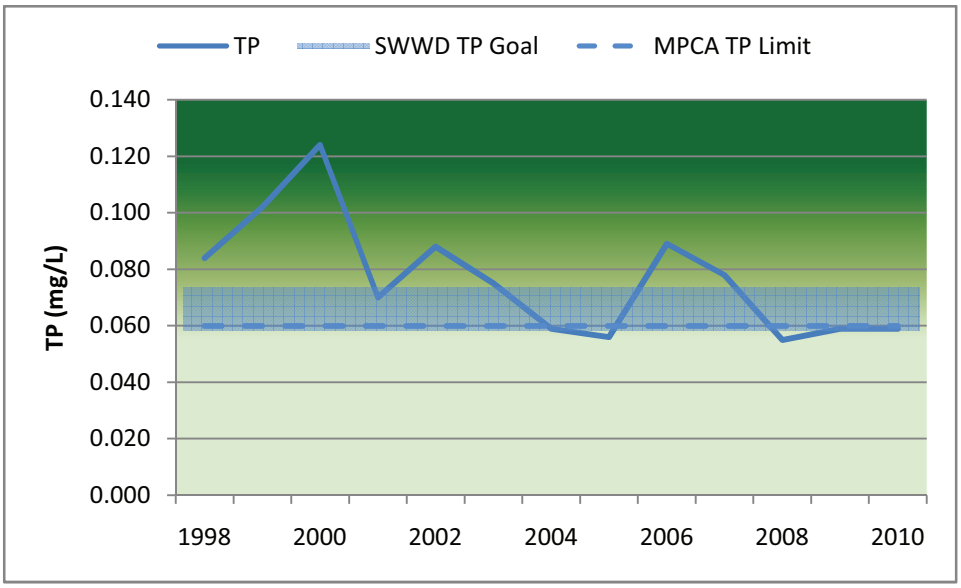
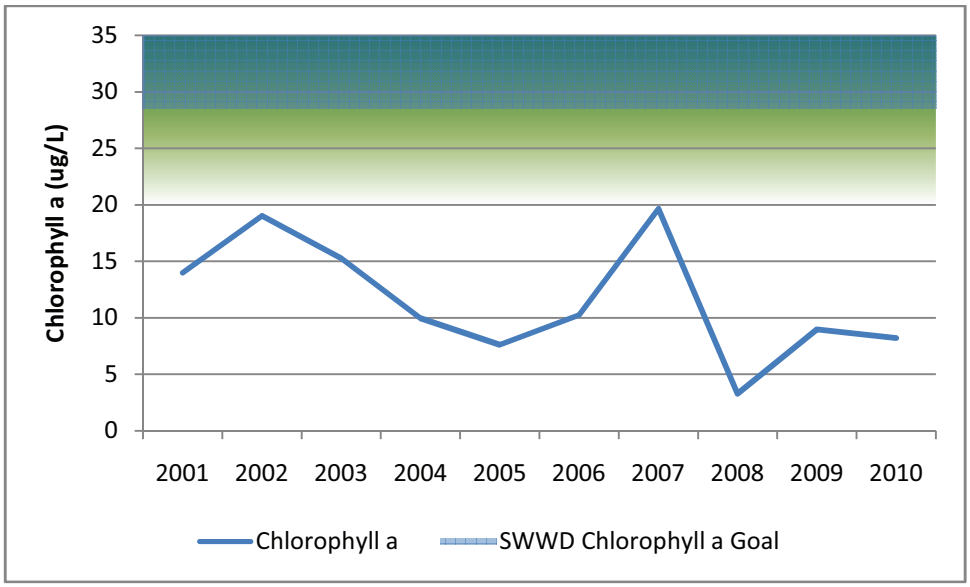
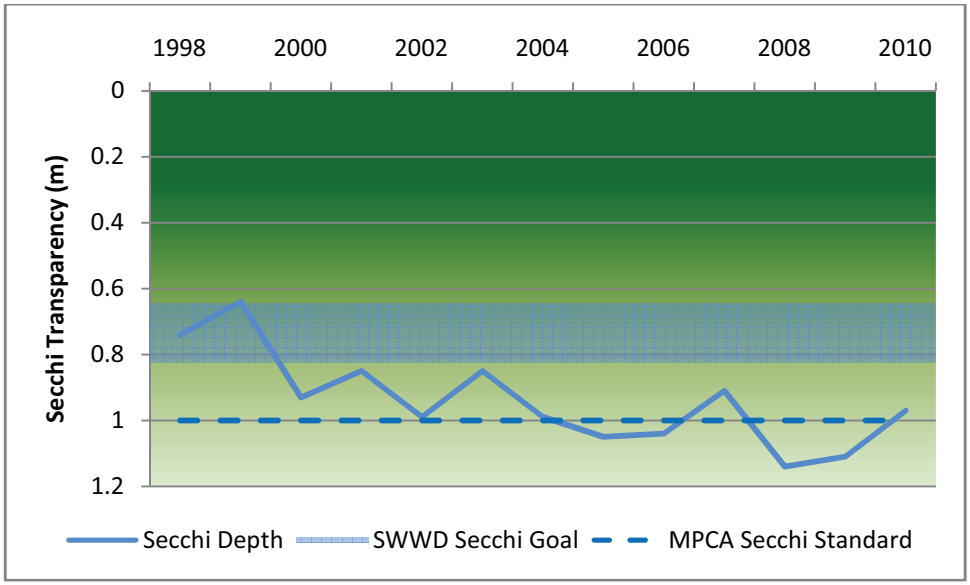


Figure 15: Armstrong Lake Historical Mean Growing Season Chlorophyll a[1] Concentrations



[1]Uncorrected trichromatic chlorophyll a concentrations are displayed in this figure and are the basis of the Met Council lake grading system. MnPCA standards apply to Pheophytin a corrected chlorophyll a concentrations.

Figure 16: Armstrong Lake Historical Mean Growing Season Secchi Transparency



Parameter	Trophic Status	Lake Grades												
		98	99	00	01	02	03	04	05	06	07	08	09	10
Total Phosphorus	63; Eutrophic	D	D	D	D	D	D	C	C	D	D	C	C	C
Chlorophyll a	51; Eutrophic				B	B	B	A	A	B	B	A	A	A
Secchi Transparency	60; Eutrophic	D	F	D	D	D	D	D	D	D	D	D	D	D
Overall	Eutrophic	D	D	D	D	D	D	C	C	D	D	C	C	C

Table 17: Armstrong Lake 2010 Trophic Status and Historical Lake Grades

Discussion

Armstrong Lake is characterized by a steady surface elevation showing little fluctuation. Armstrong has been and continues to be a eutrophic lake, however, year to year water quality is consistently improving. While graded C in 2010, Armstrong Lake meets, or nearly meets MnPCA shallow lake water quality standards while exceeding SWWD TSI goals. Historically, chlorophyll a concentrations are lower than expected considering total phosphorus and secchi transparency measurements. The disparity is indicative of a higher proportion of non-algal turbidity. It is possible that algae growth is limited by light, however there may also be a high proportion of TP in forms unavailable to algae. High non-algal turbidity is likely due to high rates of mixing in the shallow lake and accompanying suspension of sediments from the lake bottom. Chloride has historically been high in Armstrong Lake, likely due to de-icing materials used on County Road 10.