F. X. Browne, Inc.
Engineers • Planners • Scientists

May 2, 2015

Kirk Mackey
Twin and Walker Creek Watershed Association
875 Twin Lakes Road
Shohola, PA 18458

RE: Twin and Walker Creek Watershed Monitoring Program
2015 Water Quality Monitoring Final Report
FXB File No. PA1551-15

Dear Kirk:

The purpose of this letter is to present results of the 2015 Twin and Walker Creek Watershed Monitoring Program. The primary purpose of the monitoring program is to characterize the trophic state within Big Twin Lake, Little Twin Lake, and Walker Lake based on measurements of Secchi depth, total phosphorus, and chlorophyll a. The monitoring program consisted of volunteers from the Twin and Walker Creek Watershed Association collecting lake samples from the photic zone of Big Twin Lake, Little Twin Lake, and Walker Lake and measuring the Secchi depth on four occasions during the 2015 growing season. QC Laboratories performed the total phosphorus and chlorophyll a laboratory analysis and F. X. Browne, Inc. analyzed all the 2015 lake monitoring data to prepare this report.

Results

Table 1 presents raw and averaged data for the study period. The significance of these results is described in the following sections. In all cases, confidence interval (±) is expressed as twice the standard deviation, equivalent to approximately a 95% confidence interval.

Phosphorus

Phosphorus is one of the three main nutrients of life, along with nitrogen and carbon. In the northeast United States, phosphorus is the nutrient that most often controls productivity of lake systems. Total phosphorus is a measure of all forms of phosphorus, both organic and inorganic. Total phosphorus concentrations are directly related to the trophic condition (water quality status) of a lake. Excessive amounts of phosphorus lead to algae blooms and loss of oxygen in lakes. Epilimnetic (surface water) total phosphorus concentrations less than 10 micrograms per liter (μg/L)/0.010 milligrams per liter (mg/L) are associated with oligotrophic (clean, clear water) conditions and concentrations greater than 25 μg/L (0.025 mg/L) are associated with eutrophic (nutrient-rich) conditions.

1519 State Route 86 • Saranac Lake, NY 12983 • (518) 891-1410 • Fax (215) 362-2016 • www.fxbrowne.com

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The average surface water total phosphorus concentration during 2014 was highest in Walker Lake (0.021 mg/L ± 0.013) and lowest in Little Twin Lake (0.012 mg/L ± 0.006). The average total phosphorus concentration in Big Twin Lake was 0.016 mg/L ± 0.005 mg/L. Overall, Walker Lake tended to have the highest total phosphorus concentration on each sampling date and experienced the highest overall average total phosphorus concentration. Based on total phosphorus concentrations, all three lakes were classified as mesotrophic in 2015 according to EPA trophic state criteria.

Chlorophyll a

Chlorophyll a is the green pigment in plants used for photosynthesis, and measuring it provides information on the amount of algae (microscopic plants) in lakes. Chlorophyll a concentrations can also be used to classify lake trophic state. Chlorophyll a concentrations less than 2 micrograms per liter (μg/L) are associated with oligotrophic conditions, while concentrations greater than 7-10 μg/L are associated with eutrophic conditions.

The average chlorophyll a concentration was highest in Walker Lake (5.3 mg/L ± 3.0) and lowest in Little Twin Lake (3.0 mg/L ± 1.0). The average chlorophyll a concentration in Big Twin Lake was 4.2 mg/L ± 1.8 mg/L. Therefore, based on chlorophyll a concentrations, all lakes were classified as mesotrophic during 2015. Chlorophyll a concentrations were slightly lower in all three lakes in 2015 compared to 2014.

Transparency

Transparency is a measure of water clarity in lakes and ponds. It is determined by lowering a 20 cm black and white disk (Secchi disk) into a lake to the depth where it is no longer visible from the surface. Since algae are the main determinant of water clarity in non-stained lakes that lack excessive amounts of inorganic turbidity (suspended silt), transparency is used as an indicator of lake trophic state. Transparencies greater than 4.6 meters (15.1 feet) are associated with oligotrophic conditions, while transparencies less than 2 meters (6.6 feet) are associated with eutrophic conditions.

The average Secchi disk transparency was highest (most favorable) in Little Twin Lake (3.76 m ± 0.62), and lowest at Walker Lake (1.55 m ± 0.42). The average Secchi disk transparency was 2.69 m ± 0.44 m in Big Twin Lake. Therefore, based on Secchi disk transparency, Little Twin Lake and Big Twin Lake were classified as mesotrophic and Walker Lake was classified as eutrophic during 2015. Transparencies increased (improved) slightly in Big Twin Lake, increased (improved) slightly in Little Twin Lake, and remained the same in Walker Lake in 2015 compared to 2014.

Trophic State

Trophic state is a key term used in limnology to describe the amount of algae and macrophytes (aquatic plants) found in a lake. *Oligotrophic* lakes have few algae and macrophytes and appear clean and clear, while *eutrophic* lakes show an overabundance of growth and often have a pronounced green color due to algae. *Eutrophication* is a natural process whereby lakes increase in trophic state over long periods of time. However, the process of eutrophication can be greatly accelerated by human activities (such as watershed development and sewage disposal) which introduce additional nutrients, organic matter and silt into the lake system. This cultural eutrophication can be reversed by controlling human inputs, but in many cases additional in-lake treatments are required in order to accelerate this rehabilitation process.

The Carlson (1977) Trophic State Index (TSI) is an extremely valuable tool for the evaluation of lakes. This index is calculated using summer averages for total phosphorus, chlorophyll a, and/or transparency (Secchi depth) data. In order to calculate this index, each seasonal average is logarithmically converted to a scale of relative trophic state ranging from 1 to 100. This index was constructed such that an increase in ten units represents a doubling in algal biomass. For example, a lake with a chlorophyll a TSI of 40 has twice as much algae as a lake with a TSI value of 30. Generally, TSI values less than 37 are considered oligotrophic, while TSI values greater than 51 are considered eutrophic.

Average values for Secchi depth, total phosphorus, and chlorophyll a were used to compute trophic state indices following Carlson, 1977. The TSI values for each lake are shown in Table 1. Figures 1, 2, and 3 compare trophic state indices for 2015 with those calculated for previous years. The 2015 TSI values are all slightly lower than the 2014 values. These values have been fluctuating slightly over the past few years but are remaining mostly in the mesotrophic range.

Dissolved Oxygen and Temperature

In late spring or the beginning of summer, temperate lakes develop stratified layers of water, with warmer water near the lake's surface (epilimnion) and colder water near the lake's bottom (hypolimnion). As the temperature difference becomes greater between these two water layers, the resistance to mixing increases. Under these circumstances, the epilimnion (top water) is usually oxygen-rich due to photosynthesis and direct inputs from the atmosphere, while the hypolimnion (bottom water) may become depleted of oxygen due to oxygen being consumed by organisms decomposing organic matter at the lake bottom.

Conversely, shallow temperate lakes may never develop stratified layers of water. For these shallow lake systems, wave action caused by the wind may be sufficient to keep the entire lake completely mixed for most of the year. In shallow lakes, low dissolved oxygen levels may occur above the lake sediments even though most of the water in the lake is completely mixed.

Both shallow and deep temperate lakes can have low dissolved oxygen concentrations near the surface of the lake sediments. If low dissolved oxygen levels occur near the lake bottom, sediments may release significant amounts of nutrients (primarily orthophosphorus and ammonium) back into the lake, thereby allowing for more nutrients for algae and aquatic plant growth.

In general, the optimal water temperature for trout is 55 to 60ºF (12.8 to 15.6ºC). Trout may withstand water temperatures above 80ºF (26.7ºC) for several hours, but if water temperatures exceed 75ºF (23.9ºC) for extended periods, trout mortality is expected (Pennsylvania State University). A safe minimum dissolved oxygen concentration for trout is 5 mg/L. Warm water species (i.e. golden shiners, bass, bluegill) grow well when water temperatures exceed 80ºF (26.7ºC). For many warm water fish species, 3 mg/L is considered a safe minimum dissolved oxygen concentration.

In 2015, volunteers measured profiles of dissolved oxygen and temperature on each of the sampling dates. The dissolved oxygen and temperature profiles for all three lakes are included in Table 2 and Figures 4 and 5.

During the 2015 growing season, the following observations can be made with respect to dissolved oxygen and temperature readings:

- All three lakes were thermally stratified during the summer months of June through September.
- Big Twin Lake exhibited a temperature difference between the surface and bottom that ranged from 6.7 °C (September) to 11.47°C (June)
- Little Twin Lake exhibited a temperature difference between the surface and bottom that ranged from 12.3°C (September) to 16.17°C (June).
- Walker Lake exhibited a temperature difference between the surface and bottom that ranged from 11.3°C (September) to 16.88°C (July).
- Maximum surface temperatures were 24.0°C in Big Twin Lake in July, 24.76ºC in Little Twin Lake in July and 25.76°C in Walker Lake in July.
- During 2015, the temperatures in all three lakes was very similar to the temperatures in 2014. Temperature was not measured in August 2015.
- Big Twin Lake and Walker Lake exhibited oxygen depletion in the bottom waters. Oxygen depletion in Walker Lake has been significant and well defined for several years. Oxygen levels quickly decrease to less than 2 mg/L at a depth of only 3.0 meters. A lake aeration system for Walker Lake may be a good option to eliminate the oxygen depletion problem and improve the overall water quality of the lake. Little Twin Lake was well oxygenated throughout the water column and exhibited higher oxygen

concentrations at mid-depths, which occurs in some oligotrophic and mesotrophic lakes when phytoplankton at mid-depths produce extra oxygen.

pH and Conductivity

The acidity of water (concentration of hydrogen ions in water) is measured as pH and reported in standard units on a logarithmic scale that ranges from one to fourteen. Each pH unit represents a thousand-fold change in the free hydrogen ion concentration. On the pH scale, seven is neutral, lower numbers are more acidic, and higher numbers are more basic. Factors that can significantly affect the pH in a lake include the mineral composition of the surrounding watershed soils and the amount of algal growth occurring in the lake. Intense algal growth can drastically lower carbon dioxide concentrations in the water, which causes a rise in pH and alkalinity. In general, pH values between 6.0 and 8.0 are considered optimal for the maintenance of a healthy lake ecosystem. Many species of fish and amphibians have difficulty with growth and reproduction when pH levels fall below 5.5 standard units (s.u.). In almost all lakes, pH tends to be somewhat lower within the bottom waters due to carbon dioxide released by bacterial decomposition.

June and July pH values were suspicious and probably not accurate due to multiprobe problems. No pH values were measured in August since the meter was being serviced and ultimately replaced. The pH values in September were similar in all lakes and ranged from 7.08 s.u. to 6.24 s.u. in Walker Lake, 7.35 s.u. to 6.69 s.u. in Little Twin Lake, and 7.24 s.u. to 6.24 s.u. in Big Twin Lake.

Conductivity (or specific conductance) is a measure of the ability of water to conduct electric current, and is related to the amount of dissolved ions within the water. Higher conductivity values are indicative of pollution by road salt or septic systems and more eutrophic conditions in a lake. Conductivities may be naturally elevated in stained water that drains from swamps and marshes. Clean, clear-water lakes typically have conductivities of around 20 to 30 micro-mhos per centimeter (µmhos/cm) while lakes in developed areas tend to have conductivities between 50 and 150 µmhos/cm.

Conductivity levels in June, July, and August were not evaluated do to multiprobe meter problems. Measured values in June and July were suspiciously high and no measurements were taken in August. Big Twin Lake had a surface conductivity of 74 µmhos/cm and a bottom conductivity of 102 µmhos/cm in September. Little Twin Lake had the highest conductivities overall, with a surface conductivity of 143 µmhos/cm and a bottom conductivity of 167 µmhos/cm in September. Walker Lake had a surface conductivity of 80 µmhos/cm and an average bottom conductivity of 242 µmhos/cm in September. All surface and bottom conductivity values are slightly higher than in previous years.

Table 1 - 2015 Twin and Walker Creek Watershed Monitoring Program Lake Monitoring Results					
Waterbody Name	***Date Collected***		***Total Phosphorus (mg/l)***	***Chlorophyll a (mg/l)***	***Secchi Depth (m)***
Big Twin Lake	6/19/2015		0.020	4.3	3.10
	7/18/2015		0.021	1.9	3.00
	8/22/2015		0.013	4.3	2.15
	9/19/2015		0.011	6.3	2.50
Average			***0.016***	***4.2***	***2.69***
Standard deviation			***0.005***	***1.8***	***0.44***
Trophic State Index			***44***	***45***	***46***
Little Twin Lake	6/19/2015		0.008	3.0	4.00
	7/18/2015		0.008	1.7	3.10
	8/22/2015		0.021	4.0	3.45
	9/19/2015		0.011	3.2	4.50
Average			***0.012***	***3.0***	***3.76***
Standard deviation			***0.006***	***1.0***	***0.62***
Trophic State Index			***40***	***41***	***41***
Walker Lake	6/19/2015		0.010	6.4	1.50
	7/18/2015		0.013	1.0	1.00
	8/22/2015		0.038	8.0	1.70
	9/19/2015		0.021	5.6	2.00
Average			***0.021***	***5.3***	***1.55***
Standard deviation			***0.013***	***3.0***	***0.42***
Trophic State Index			***48***	***47***	***54***

Figure 1. Comparison of Phosphorus-Based Trophic State Index 2002-2015 for Big Twin Lake, Little Twin Lake, and Walker Lake

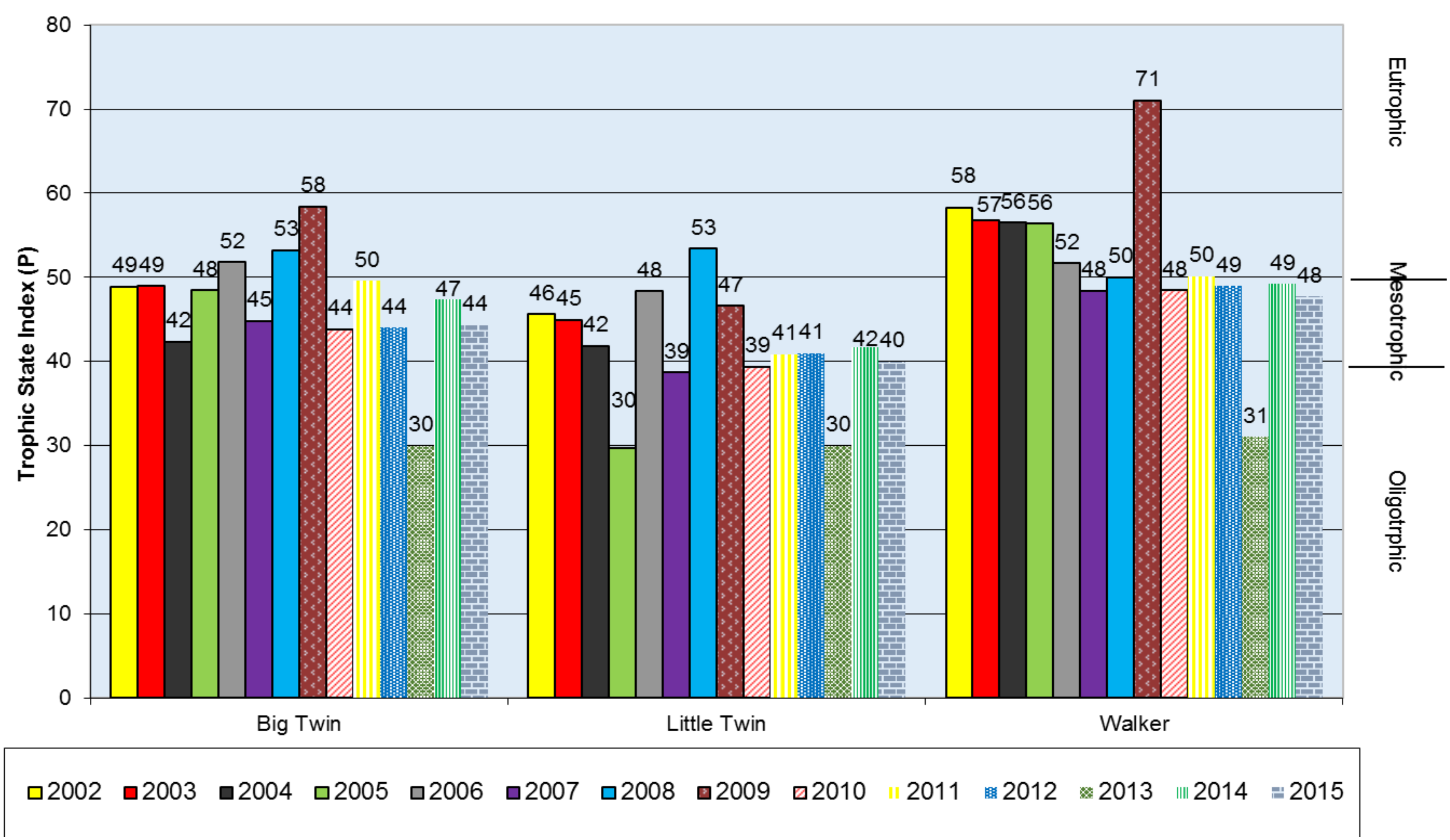


Figure 2. Comparison of Chlorophyll a - Based Trophic State Index 2002-2015 for Big Twin Lake, Little Twin Lake and Walker Lake

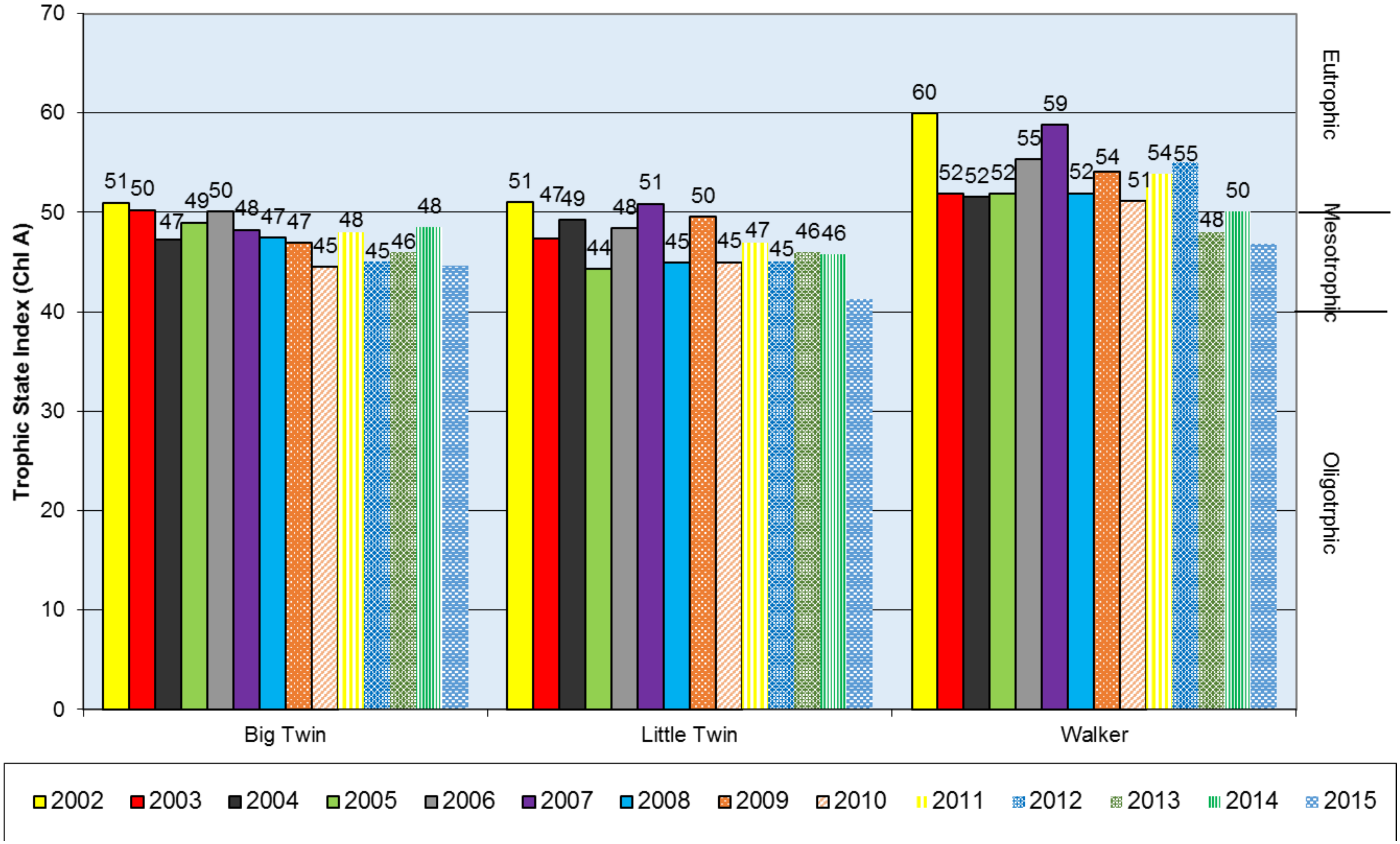


Figure 3. Comparison of Secchi Depth-Based Trophic State Index for Big Twin Lake, Little Twin Lake, and Walker Lake 1983-2015

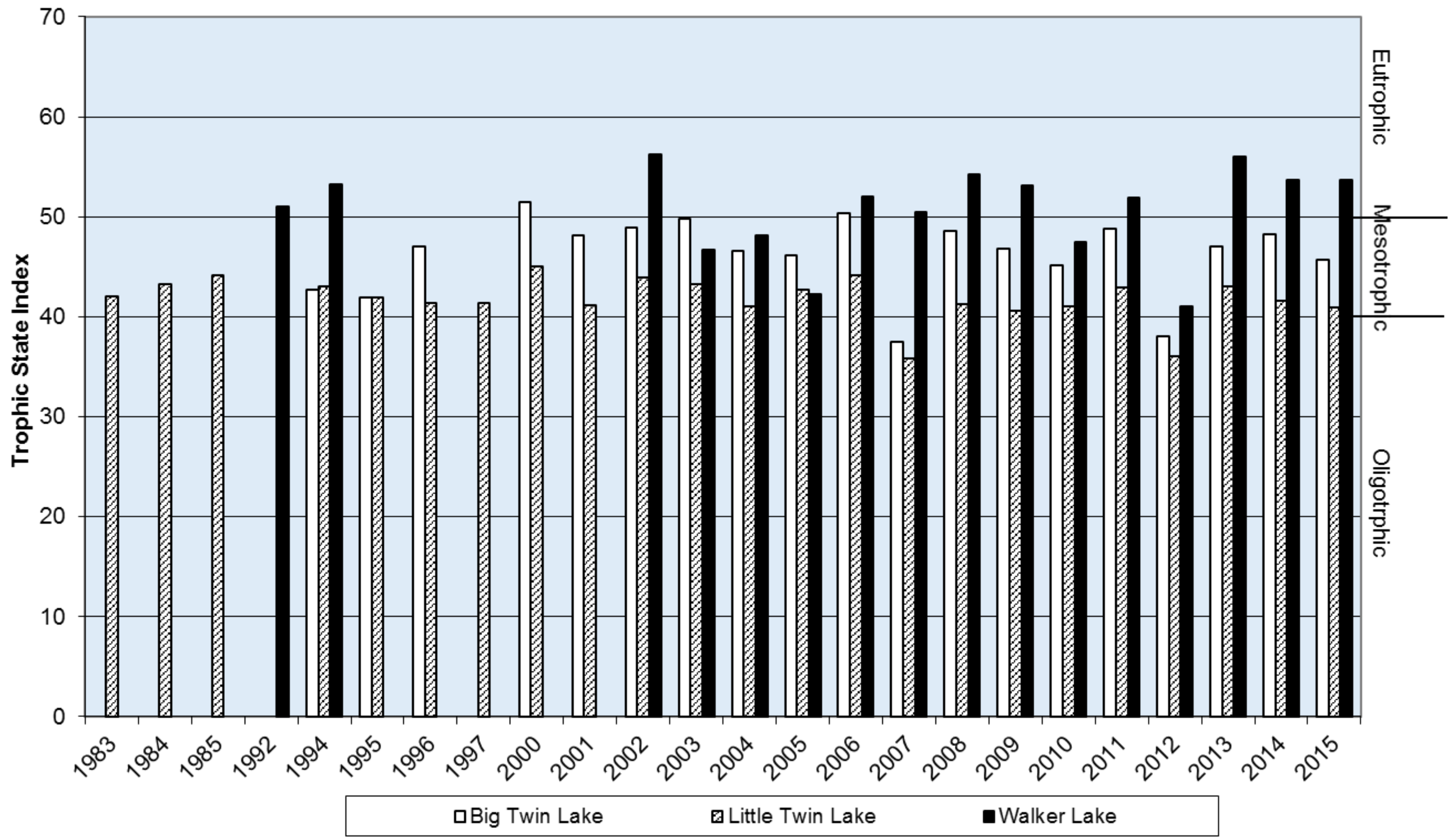


Table 2 - Chemical Profiles in Twin Lake, Little Twin Lake, and Walker Lake for 2014

Twin Lake		6/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	22.61	234	6.15	5.97	0.159
1.0	22.65	234	5.85	6.05	0.159
1.5	22.65	234	5.48	6.07	0.159
2.0	22.63	234	5.50	6.09	0.159
2.5	22.63	234	5.53	6.17	0.159
3.0	22.62	234	5.78	6.18	0.159
3.5	22.62	234	5.93	6.20	0.159
4.0	22.60	234	6.16	6.22	0.159
4.5	21.60	231	6.63	6.19	0.161
5.0	18.33	215	6.72	6.04	0.160
5.5	16.30	205	6.20	5.91	0.160
6.0	14.37	197	5.45	5.82	0.161
6.5	13.33	191	4.94	5.79	0.160
7.0	12.05	187	4.77	5.76	0.162
7.5	11.14	183	3.73	5.81	0.162
	11.47				

Twin Lake		7/18/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	24.00		8.20	6.60	
1.0	23.80		8.09	6.70	
1.5	23.80		8.13	6.75	
2.0	23.78		8.10	6.82	
2.5	23.75		8.13	6.82	
3.0	23.68		7.99	6.80	
3.5	22.35		7.25	6.50	
4.0	21.50		6.47	6.24	
4.5	20.22		4.84	5.88	
5.0	19.00		3.15	5.55	
5.5	16.70		1.38	5.12	
6.0	14.90		0.83	4.98	
6.5	13.60		0.42	4.75	
7.0	12.80		0.31	4.80	
7.5					
	11.20				

Twin Lake		8/22/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					
6.5					
7.0					
7.5					
	0.00				

Twin Lake		9/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	22.30	74	7.71	7.24	
1.0	22.30	74.1	7.62	7.18	
1.5	22.20	74.1	7.72	7.15	
2.0	22.20	74.1	7.86	7.12	
2.5	22.10	74.2	7.58	7.07	
3.0	22.00	74.1	6.82	6.78	
3.5	21.40	74.4	6.05	6.58	
4.0	21.10	74.4	5.71	6.50	
4.5	21.10	74.4	5.60	6.47	
5.0	21.10	74.6	5.10	6.39	
5.5	20.80	75.2	4.61	6.32	
6.0	19.10	82.4	0.17	6.24	
6.5	17.80	91.6	0.07	6.35	
7.0	16.70	97.2	0.06	6.43	
7.5	15.60	102	0.05	6.48	
	6.70				

Little Twin Lake		6/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	23.97	462	8.55	5.85	0.309
1.0	23.38	462	7.81	5.93	0.309
1.5	23.33	461	7.77	6.00	0.310
2.0	23.16	459	7.85	6.03	0.031
2.5	23.13	460	8.05	6.07	0.310
3.0	23.10	459	8.36	6.12	0.309
3.5	23.36	453	8.82	6.10	0.311
4.0	19.27	430	10.70	5.98	0.315
4.5	17.25	412	12.38	5.95	0.315
5.0	14.95	390	13.42	5.89	0.315
5.5	13.04	372	14.22	5.86	0.316
6.0	10.92	359	14.79	5.87	0.319
6.5	9.58	353	14.93	5.94	0.326
7.0	8.42	349	14.52	5.94	0.331
7.5	7.80	345	14.44	5.94	0.335
	16.17				

Little Twin Lake		7/18/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	24.15		7.20	6.97	
1.0	24.16		7.17	7.00	
1.5	24.16		7.17	6.98	
2.0	24.16		7.18	7.03	
2.5	24.16		7.17	7.04	
3.0	23.96		7.32	7.01	
3.5	23.64		7.55	6.98	
4.0	23.01		8.26	6.90	
4.5	21.10		9.70	6.50	
5.0	18.30		10.74	6.38	
5.5	15.72		11.17	5.96	
6.0	12.62		11.52	5.63	
6.5	11.42		11.50	5.86	
7.0	10.45		11.48	5.86	
7.5	9.31		11.30	5.84	
	14.84				

Little Twin Lake		8/22/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					
6.5					
7.0					
7.5					
	0.00				

Little Twin Lake		9/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	22.80	142.8	7.60	7.26	
1.0	22.70	142.6	7.66	7.35	
1.5	22.70	142.6	7.52	7.22	
2.0	22.70	142.6	7.40	7.22	
2.5	22.70	142.6	7.56	7.31	
3.0	22.60	142.7	7.42	7.25	
3.5	22.60	142.6	7.33	7.24	
4.0	22.50	142.4	7.10	7.12	
4.5	22.30	142.4	6.75	7.03	
5.0	21.70	142.6	6.64	6.92	
5.5	20.30	147.5	7.70	6.69	
6.0	17.80	151.3	10.65	6.85	
6.5	14.50	154	11.80	6.87	
7.0	12.10	166.9	9.24	6.52	
7.5	10.50	160.1	6.20	6.73	
	12.30				

Walker Lake		6/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	23.45	265	10.28	6.38	0.177
1.0	23.49	267	9.71	6.41	0.179
1.5	23.44	267	9.41	6.41	0.179
2.0	23.21	266	8.92	6.38	0.179
2.5	21.52	254	7.82	6.31	0.177
3.0	18.94	226	5.28	6.14	0.164
3.5	16.63	206	1.67	5.91	0.159
4.0	13.64	207	1.23	5.82	0.172
4.5	11.33	210	0.53	5.70	0.185
5.0	10.09	220	0.46	5.69	0.200
5.5	9.15	242	0.41	5.65	0.277
6.0	8.38	328	0.31	5.62	0.313
6.5	7.88	358	0.29	5.72	0.349
	15.57				

	Walker Lake		7/18/2015			
	z	temp	cond	DO	pH	TDS (g/L)
	0.0	25.74		8.67	5.18	
	1.0	24.30		8.44	5.13	
	1.5	24.06		8.15	5.39	
	2.0	23.79		7.64	5.56	
	2.5	21.63		3.67	5.17	
	3.0	19.28		1.82	4.63	
	3.5	17.45		0.76	4.39	
	4.0	15.37		0.49	4.40	
	4.5	13.10		0.40	4.09	
0	5.0	11.15		0.35	3.79	
0	5.5	9.60		0.32	3.86	
0	6.0	8.91		0.27	4.14	
	6.5					
		16.83				

Walker Lake		8/22/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					
6.0					
6.5					
	0.00				

Walker Lake		9/19/2015			
z	temp	cond	DO	pH	TDS (g/L)
0.0	21.30	79.6	7.63	7.08	
1.0	21.30	79.7	7.44	7.06	
1.5	21.20	79.8	7.14	7.05	
2.0	21.20	79.9	7.32	7.03	
2.5	21.20	79.8	7.66	7.02	
3.0	21.10	80	7.33	7.01	
3.5	19.20	77	3.60	6.28	
4.0	17.00	86.3	0.27	6.24	
4.5	14.90	97.8	0.08	6.32	
5.0	12.90	118	0.04	6.42	
5.5	11.00	182.7	0.04	6.39	
6.0	10.00	242.6	0.04	7.08	
6.5					
	11.30				

Figure 4. Temperature Profiles in 2015 for Big Twin Lake, Little Twin Lake and Walker Lake

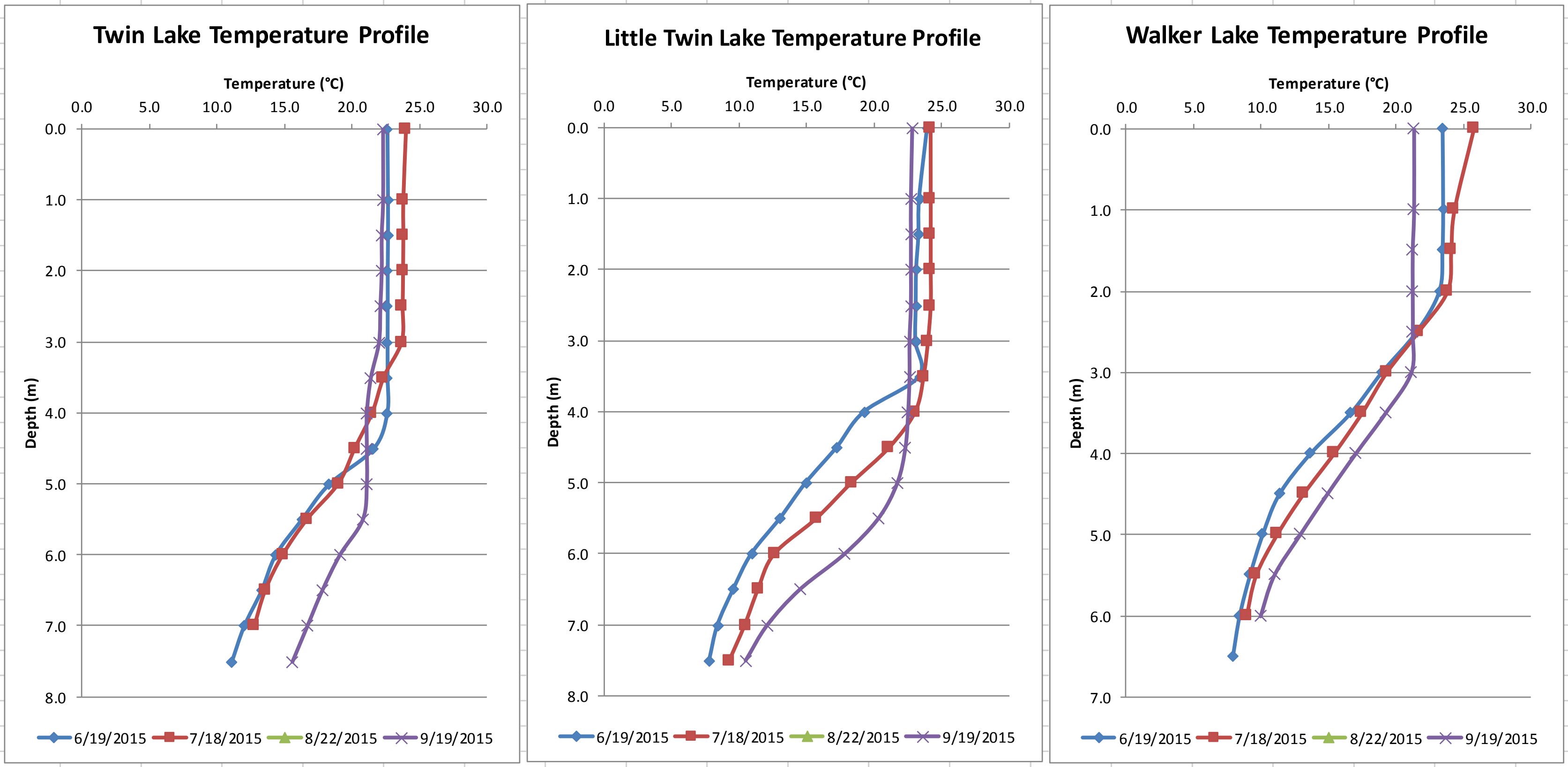
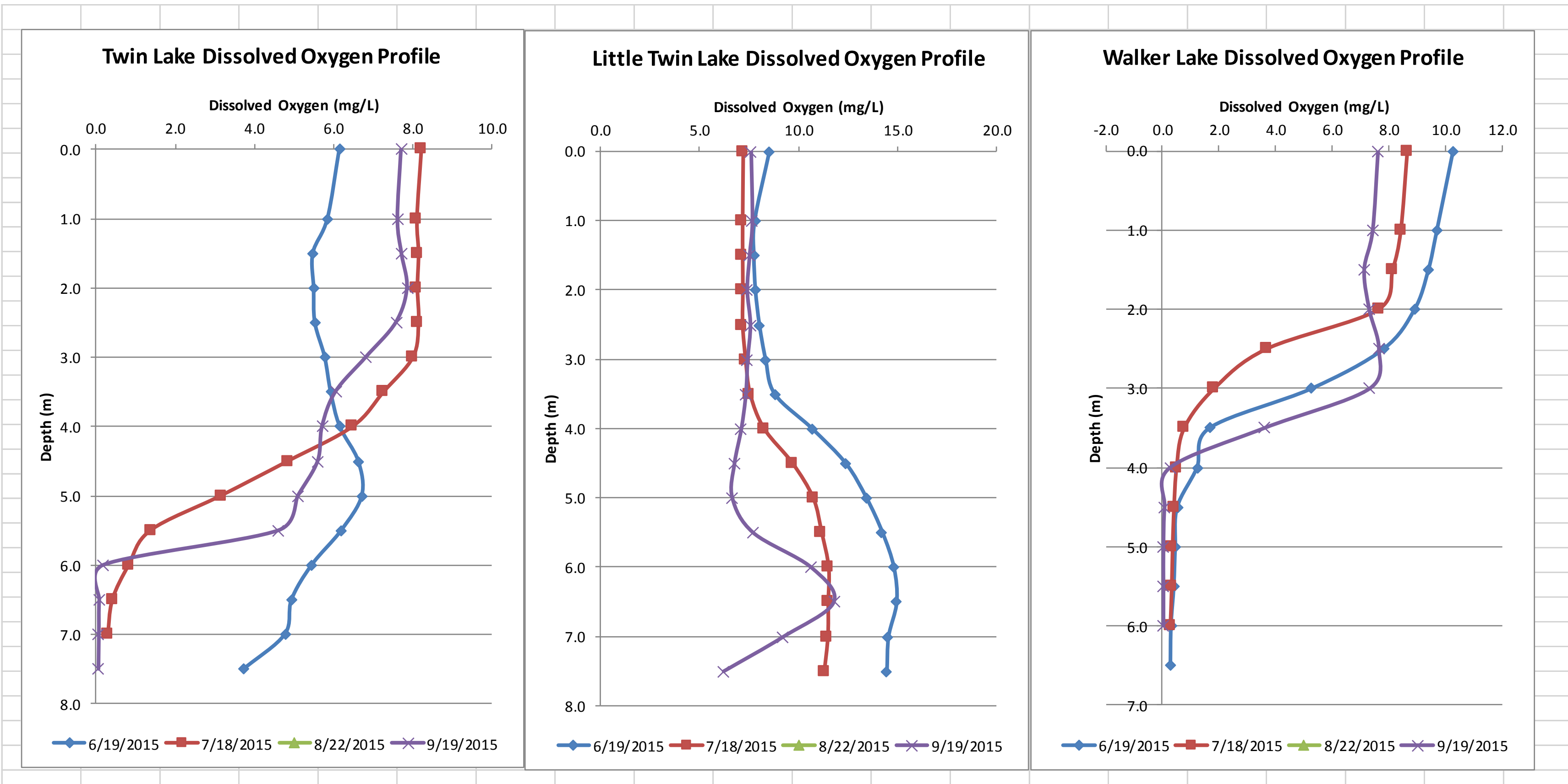


Figure 5. Dissolved Oxygen Profiles in 2015 for Big Twin Lake, Little Twin Lake and Walker Lake



Big Twin Lake

Big Twin Lake can be classified as mesotrophic with respect to total phosphorus, chlorophyll a and transparency during 2015. Overall, conditions were similar to the past few years. Based upon oxygen and temperature profiles, Big Twin Lake would not be capable of sustaining a cold-water fishery for most of the summer, but warm-water fish should do well within the lake. The pH level of the lake was excellent. Conductivity levels are relatively low and are the lowest of all lakes. The water quality in Big Twin Lake was better in 2015 compared to 2014.

Little Twin Lake

Little Twin Lake was mesotrophic with respect to total phosphorus, chlorophyll a and Secchi disk transparency during 2015. Little Twin continued to have the best water quality of the three lakes. All three trophic state indicators (total phosphorus, chlorophyll a, and Secchi disk transparency) have remained relatively constant for the past five years indicating that the water quality in Little Twin Lake is stable. Based upon oxygen and temperature profiles, Little Twin Lake may be capable of supporting a cold-water fishery, especially using the less sensitive cold-water fish, such as brown trout and rainbow trout. The pH level of the lake was excellent. The conductivity in Little Twin Lake is almost double that of Big Twin Lake and Walker Lake; however, the conductivity values are still within normal ranges for lakes located in developed watersheds. Water quality in Little Twin Lake was better in 2015 compared to 2014.

Walker Lake

Walker Lake was mesotrophic based on the total phosphorus and chlorophyll a TSI values and eutrophic based on the Secchi depth TSI during 2015. Overall, Walker Lake would be classified as meso-eutrophic or borderline eutrophic for 2015. Based upon oxygen and temperature profiles, Walker Lake would not be capable of sustaining a cold-water fishery but warm-water fish should do well within the lake. There is a relatively large anoxic zone in the bottom waters of the lake. Walker Lake may benefit from lake aeration which would aerate the bottom waters of the lake, improve water quality, and increase fish habitat. The pH level of the lake was excellent, and conductivity levels are relatively low and similar to Big Twin Lake.

Conclusions and Recommendations

In general, Walker Lake had the worst water quality in 2015 while Little Twin Lake had the best water quality in 2015. In general, water quality has remained relatively stable over the past 5 years. However, year to year variability indicates the lakes are sensitive to any increase in nutrient inputs. Dissolved oxygen and temperature profiles have indicated that Big Twin Lake and Walker Lake experience oxygen depletion in the bottom waters, while Little Twin Lake does not and may be capable of supporting a cold-water fishery. The oxygen depletion problems in Walker Lake are more significant in Walker Lake. Evaluation of an aeration system from Walker Lake is recommend and would include additional dissolved oxygen and temperature monitoring.

Nutrient reduction strategies that reduce the introduction of nutrients into the lakes should be implemented to maintain or reestablish mesotrophic conditions in the Walker Lake watershed. Such strategies include septic system upgrades, diversion and/or treatment of storm water, and the control of

Canada geese populations. An educational program for lakefront property owners should be put in place in order to instruct those homeowners on proper lakefront best management practices for protecting and restoring good water quality. This program can include lectures and educational materials on lakefront landscaping, proper use of fertilizer, pet waste management, runoff control, and the identification and management of invasive species, aquatic plants, and algae.

Thank you again for choosing F. X. Browne, Inc. for your lake consulting needs. We look forward to continuing our work together in the future. If you should have any questions concerning the 2015 report, please contact me at mrmartin@fxbrowne.com at any time.

Sincerely,

F. X. Browne, Inc.

Marlene R Martin

Marlene R. Martin, P.E.
Vice President, Watershed Management