



December 9, 2009

Kirk Mackey  
Twin and Walker Creek Watershed Association  
65 Lenape Lane  
Twin Lakes, PA 18458

RE: Twin and Walker Creek Watershed Monitoring Program  
2009 Water Quality Monitoring Final Report  
FXB File No. PA1551-08

Dear Kirk:

The purpose of this letter is to report results from the 2009 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 2009 growing season. F. X. Browne, Inc. performed the total phosphorus and chlorophyll a laboratory analysis and analyzed all the 2009 lake monitoring data.

### ***Results***

Table 1 presents raw and averaged data for the study period. The average surface water total phosphorus concentration was highest in Walker Lake (0.101 mg/L  $\pm$  0.153) and lowest in Little Twin Lake (0.019 mg/L  $\pm$  0.014). The average chlorophyll a concentration was highest in Walker Lake (11.0 mg/L  $\pm$  8.2) and lowest in Big Twin Lake (5.3 mg/L  $\pm$  2.5). The Secchi disk transparency was highest (most favorable) in Little Twin Lake (3.85 m  $\pm$  1.48), and lowest at Walker Lake (1.61 m  $\pm$  0.19).

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 2009 with those calculated for previous years. It is important to note that, as evidenced by the high standard deviation scores, the total phosphorus averages were increased by the high total phosphorus concentrations in each lake during the August sampling date.

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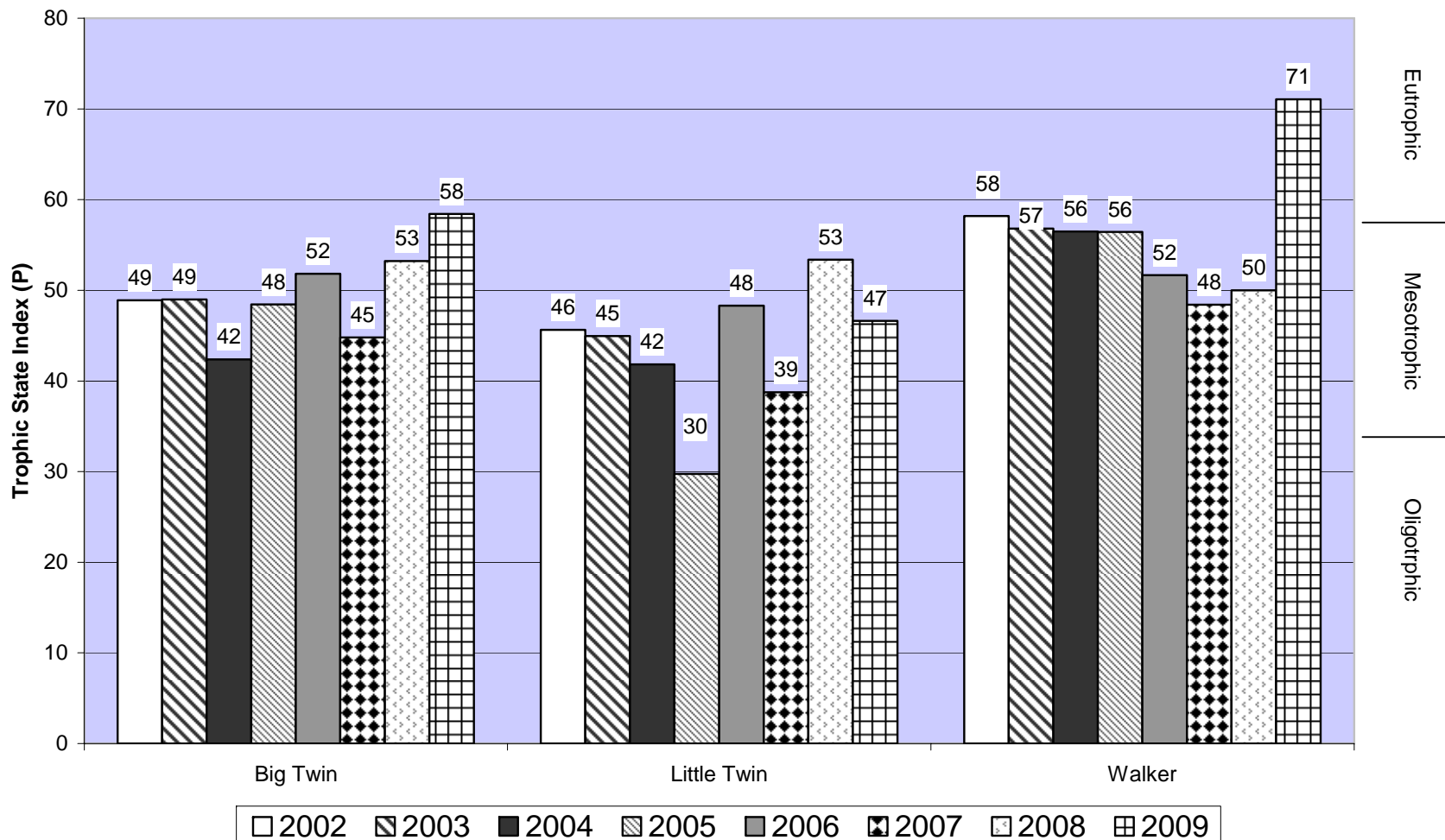
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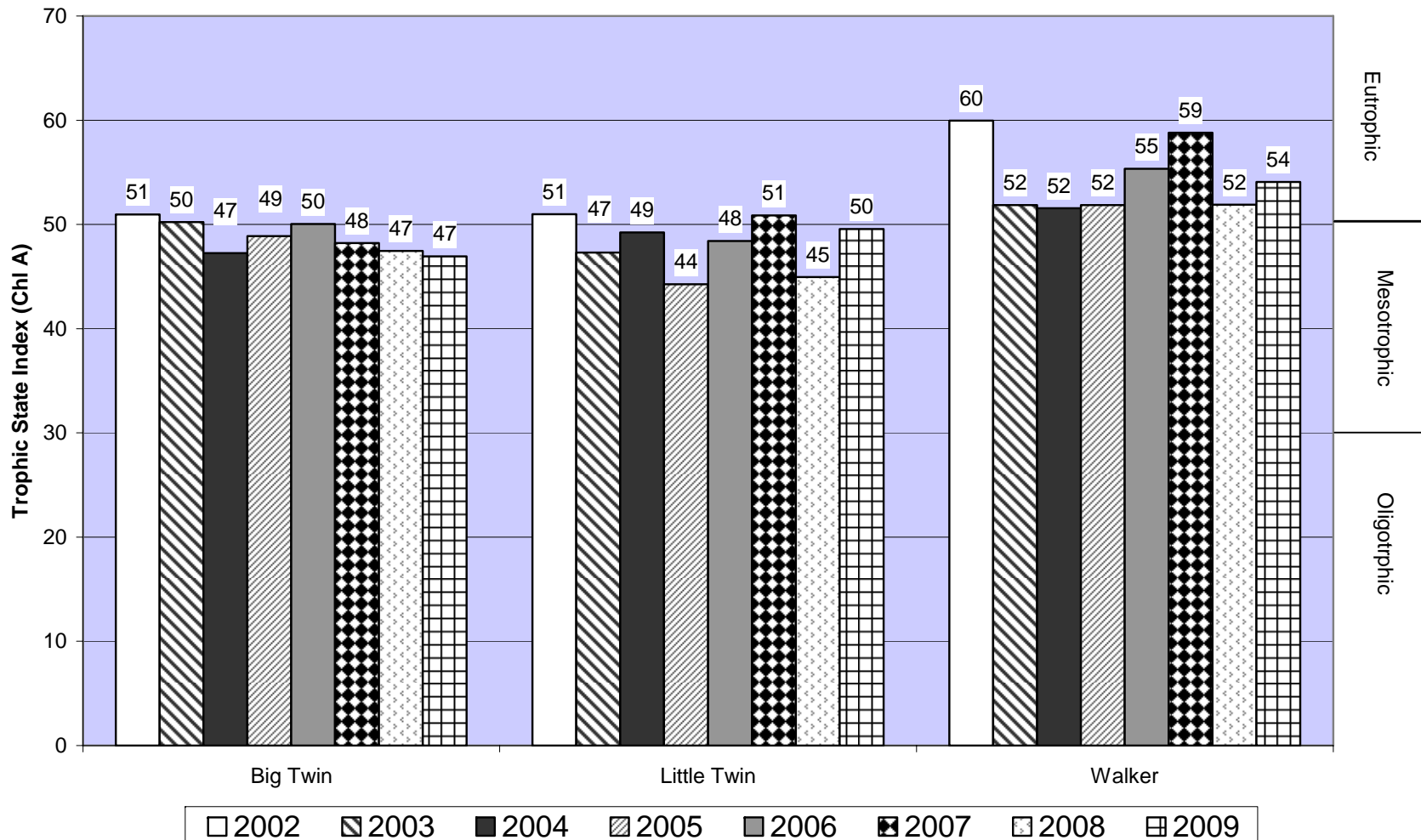
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<b>Table 1. 2009 Twin and Walker Creek Watershed Monitoring Program Lake Monitoring Results</b>					
<i>Waterbody Name</i>	<i>Date Collected</i>		<i>Total Phosphorus (mg/l)</i>	<i>Chlorophyll a (mg/l)</i>	<i>Secchi Depth (m)</i>
Big Twin Lake	6/28/2009		0.021	3.6	2.40
	7/27/2009		0.038	2.9	3.10
	8/23/2009		0.101	8.4	3.10
	10/5/2009		0.012	6.3	1.40
<b>Average</b>			<b>0.043</b>	<b>5.3</b>	<b>2.50</b>
<b>Standard deviation</b>			<b>0.040</b>	<b>2.5</b>	<b>0.80</b>
<b>Trophic State Index</b>			<b>58</b>	<b>47</b>	<b>47</b>
Little Twin Lake	6/28/2009	<	0.006	8.9	5.00
	7/27/2009		0.019	5.9	5.00
	8/23/2009		0.039	3.3	3.50
	10/5/2009		0.012	9.6	1.90
<b>Average</b>			<b>0.019</b>	<b>6.9</b>	<b>3.85</b>
<b>Standard deviation</b>			<b>0.014</b>	<b>2.9</b>	<b>1.48</b>
<b>Trophic State Index</b>			<b>47</b>	<b>50</b>	<b>41</b>
Walker Lake	6/28/2009		0.034	4.8	1.75
	7/27/2009		0.028	22.9	1.40
	8/23/2009		0.332	9.5	1.80
	10/5/2009		0.019	6.8	1.50
<b>Average</b>			<b>0.103</b>	<b>11.0</b>	<b>1.61</b>
<b>Standard deviation</b>			<b>0.153</b>	<b>8.2</b>	<b>0.19</b>
<b>Trophic State Index</b>			<b>71</b>	<b>54</b>	<b>53</b>

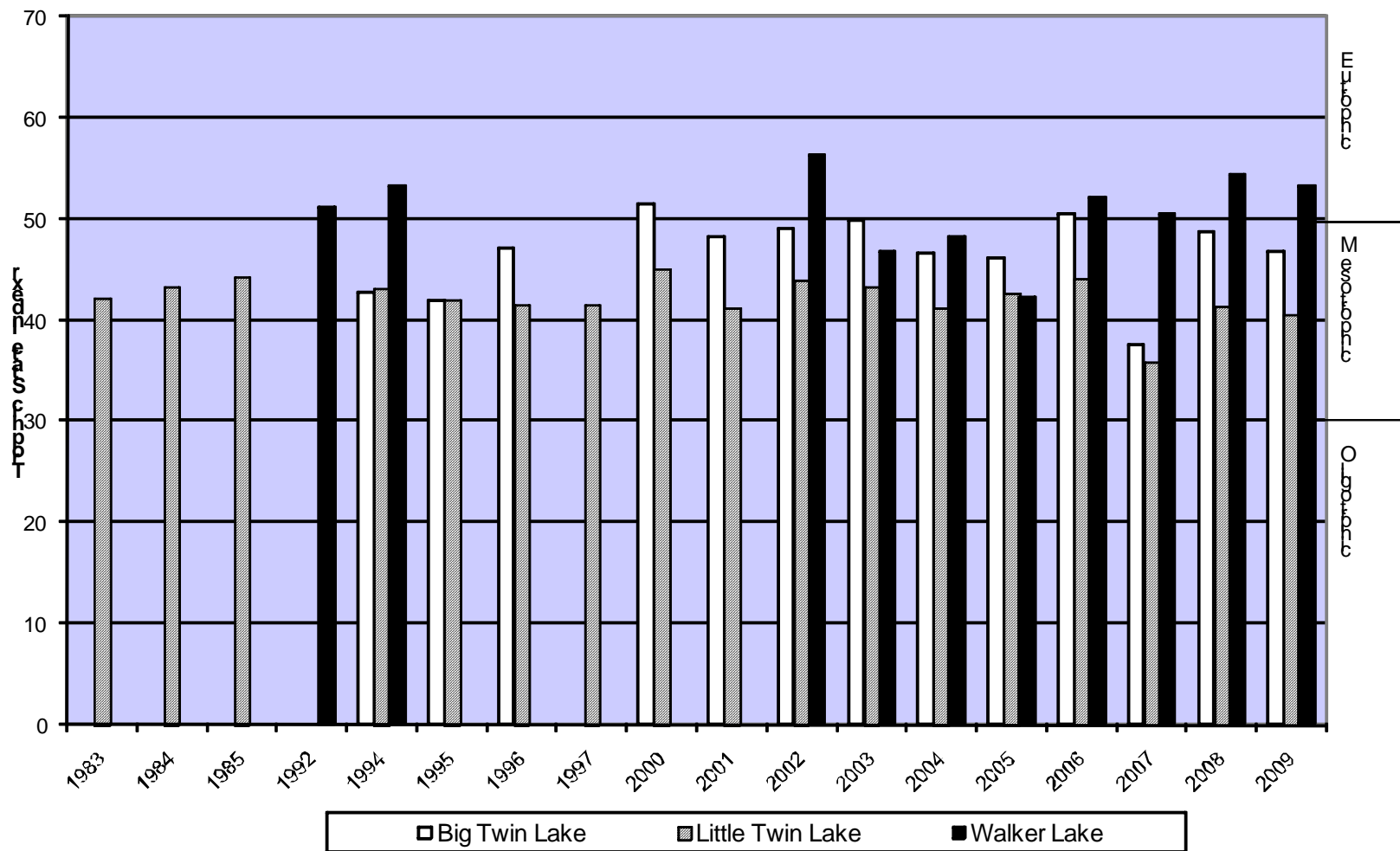
**Figure 1. Comparison of Phosphorus-Based Trophic State Index 2002-2009 for Big Twin Lake, Little Twin Lake, and Walker Lake**



**Figure 2. Comparison of Chlorophyll *a* - Based Trophic State Index 2002-2009 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 1983-2009**



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### Big Twin Lake

Big Twin Lake can be classified as eutrophic with respect to total phosphorus and mesotrophic with respect to chlorophyll a and transparency during 2009. The total phosphorus TSI value was the highest of any study year, but was elevated by the high August total phosphorus value. The chlorophyll a TSI value was lower (improved) in 2009 compared to recent years. The Secchi disk TSI value at Big Twin Lake was generally comparable to recent study years.

### Little Twin Lake

Little Twin Lake was mesotrophic with respect to total phosphorus, chlorophyll a and transparency during 2009. Little Twin generally had the best water quality of the three lakes. Little Twin Lake had a higher than average chlorophyll a TSI value in 2009; this average was elevated by a very high July chlorophyll a value.

### Walker Lake

Walker Lake can be classified as eutrophic during 2009. The total phosphorus TSI value in particular was much higher than any of the other study years; this was due at least in part to a high total phosphorus concentration in August of 0.332 mg/L. However, all of the trophic state indicators fell within the eutrophic range in 2009 at Walker Lake.

### ***Conclusions and Recommendations***

The water quality in the Twin and Walker Lakes showed some improvement in 2009 over past years with respect to chlorophyll a and transparency values. However, total phosphorus TSI values were higher in all three lakes than in recent years. This is most likely due to the high July total phosphorus values, which may have been weather-related. The water quality was better at all three lakes in early October than it was earlier in the summer, which may have been related to climatic influences. The first half of the summer was very rainy, which allowed plenty of nutrients to enter the lakes. By the end of the summer, drier conditions prevailed and water quality (especially transparency) improved. Nutrient reduction strategies that reduce the introduction of nutrients into the lakes should be implemented to maintain or reestablish mesotrophic conditions. Such strategies may include septic system upgrades, stormwater management strategies, and control of Canada geese populations.

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 2009 report, please contact me at rbuerkett@fxbrowne.com at any time.

Sincerely,

**F. X. Browne, Inc.**



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