

## **Town Lake Goals: Current Status**

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### **Introduction**

Goals were established for Town Lake, an important natural resource for the City of Austin, as part of a comprehensive study of lake conditions which was completed in 1992 (COA 1992a, COA 1992b, COA 1992c). When a review of lake data through 2000 was finished in 2004 (COA 2004), the goals were revised. In what follows, the status of the lake relative to both the original and the revised goals is assessed.

Town Lake data from mainstem sites with long term sampling histories was used. This data was divided in four groups: 1975-1990, 1991-1995, 1996-2000, 2001-2003. Data from the earliest group represents the status of the lake at the time the goals were set, and is compared to data from the latest group to determine whether our goals have been met. Only significant changes in concentrations or loads are reported.

Loads were estimated from flow-weighted storm concentrations at Shoal Creek at 12<sup>th</sup> Street and Barton Creek at Loop 360. All acceptable storm data from Shoal Creek was used (storm score >50 (COA 1997)), due to a paucity of higher scoring storms scores in the early period. Higher quality storm data (storm score >70) was used from Barton Creek. The flow-weighted mean concentrations are the population marginal means or expected values of each parameter at the mean storm flow.

### **Goals set in the 1992 Town Lake Report**

The goals that were set in 1992 addressed six problems in Town Lake: chlordane contamination of fish, nuisance algae blooms, toxins in lake sediment, potential sediment build-up in the lake, trash and debris, and oil and grease. The goals were to eliminate the fish consumption advisory, to reduce the number of algae blooms to one per year, to reduce toxic concentrations in sediment by 50%, to reduce the urban sediment load by

50%, to reduce trash by 50-70%, and to reduce the oil and grease input load by 25%. Of these goals the first four have been met, and there is insufficient data to determine the status of the last two.

**Table 1. Status of Town Lake in 2004 with respect to Goals set in 1992.**

<b>Goal</b>	<b>Status in 2004</b>
Elimination of consumption advisory for Town Lake fish.	MET: Advisory removed by Texas Department of Health (TDH) in 1999.
No more than one major algae bloom per year.	MET: Achieved since 1995. One bloom each in 1999, 2000, 2001; none in other years.
Reduction of toxic contaminant concentrations in lake sediment by 50%.	MET: 47% average reduction in sediment concentrations for lead, zinc, copper, chlordane, DDT, DDD, and DDE from the 1975-1990 period to the 2001-2003 period. (Concentrations normalized by organic carbon content would show a greater average reduction)
Reduction in sediment load from urban watersheds by 50%.	MET: 62% average reduction in storm TSS concentrations from the 1975-1990 period to the 2001-2003 period.
Reduction in trash input to the lake by 50%	Insufficient data.
Reduction in oil and grease load by 25%.	Insufficient data.

While the specific goals have been met, there are still concerns related to the original problems in Town Lake.

- There is, at present, no fish consumption advisory for Town Lake fish, but mercury levels in the fish are above advisory levels adopted by EPA in 2001. These levels have not been adopted by the TDH, but their adoption in the future could lead to reinstatement of a consumption advisory.
- Major algae blooms are no longer frequent, but both average and peak chlorophyll *a* concentrations are increasing. Average chlorophyll *a* concentrations have increased to the border between oligotrophic and mesotrophic conditions. Non bloom concentrations are higher than in 1975-1990 but remain in the oligotrophic category.
- Lead, zinc, and copper were identified as representative toxins in Town Lake, and chlordane, DDT, DDD, DDE were historically above sediment concern levels. All of these chemicals have decreased in Town Lake sediment since 1975-1990 except for zinc which has remained the same over time. Total organic carbon (TOC) has increased in lake sediment from 2% in 1975-1990 to 5% in 2001-2003. TOC may be used to normalize organic compounds, so the reduction in the pesticides is greater than specified. However, Chlordane and DDE still have 80% and 30% of their concentrations greater than the Probable Effects Concentration (PEC) respectively. Also Polycyclic Aromatic Hydrocarbons (PAHs), which were below concern levels in 1975-1990 have increased 10-fold, and are now all between the Threshold Effects Concentration (TEC) and the PEC.
- The decrease in sediment loading from urban creeks was estimated from the decrease in flow weighted mean storm TSS concentrations in Shoal Creek. Data was not available for other urban creeks entering Town Lake.

**Revised Goals listed in the Update of the Town Lake Report (data through 2000)**

Based on feasibility and on Department Masterplan goals, the goals adopted in 1992 for Town Lake were revised (COA 2004). The revised goal was to maintain existing conditions, from the 1975-1990 period, for four problem areas: algae blooms, toxic sediments, sedimentation, and aesthetics/trash and debris. Lake target goals, and strategies and watershed specific targets were set (Table 2).

**Table 2. Town Lake Problem Areas and Goals (COA2004)**

<b>Problem Area</b>	<b>Town Lake Target Goals</b>	<b>Strategies and Watershed Specific Target Goals</b>
Major Algae Blooms	<b>Maintain existing conditions</b> (i.e. frequency and magnitude of algae blooms) <b>by controlling nutrient loads</b>	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%</li> <li>➤ Maintain existing load from Barton Creek</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads.</li> </ul>
Toxic Sediments	<b>Maintain existing toxic loads</b> being discharged to Town Lake, represented by TOC, COD, Cu, Pb, and Zn loads, as well as by the Spills Risk Index	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%</li> <li>➤ Maintain existing load from Barton Creek</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads</li> <li>➤ Improve the Spills Risk score to Very Good status in the future.</li> </ul>
Sedimentation	<b>Maintain existing TSS loads</b> discharged to Town Lake	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%</li> <li>➤ Maintain existing load from Barton Creek</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads</li> <li>➤ Minimize loads from future construction</li> </ul>
Aesthetics/Trash and Debris	<b>Maintain or achieve an “Excellent” VIP score</b>	Currently this goal is achieved except for the south shore of the lower segment.

These revised goals have been met in all the problem areas except in the area of aesthetics where the Visual Index of Pollution (VIP) score has improved but is not yet excellent (Table 3). Loads are estimated from flow weighted storm concentrations collected at Shoal Creek at 12<sup>th</sup> Street representing the urban watersheds, and Barton Creek at Loop 360.

**Table 3. Status of Town Lake in 2004 with respect to the Revised Goals.**

<b>Problem Area</b>	<b>Goal</b>
<b>Major Algae Blooms</b>	<b>Maintain existing conditions</b> <b>MET:</b> # of blooms is less than or equal to 1975-1990 conditions.
<b>Toxic Sediments</b>	<b>Maintain existing toxic loads represented by TOC, Copper, Lead, and Zinc as well as the Spills Risk Index</b> <b>MET:</b> Sediment is not building up in the lake, so lake concentrations are used in lieu of loads. Zinc concentrations are remaining the same over time while lead and copper have decreased by 40% and 25% respectively. TOC has increased over time, but is used to normalize organic compounds, and thus has no bearing on metals concentrations. The Spills Risk Index, developed by Pat Hartigan, has not been calculated.
<b>Sedimentation</b>	<b>Maintain existing TSS loads to Town Lake.</b> <b>MET:</b> Sediment is not building up in the lake. Total sediment load, based on flow-weighted storm TSS concentrations in contributing watersheds, is down from 1975-1990 conditions. Shoal Creek TSS concentrations at 12 <sup>th</sup> Street, representing loads from the urban creeks, are down 62%. Barton Creek TSS concentrations at Loop 360 are down 57%.
<b>Aesthetics/Trash and Debris</b>	<b>Maintain or achieve an Excellent VIP score (1)</b> <b>NOT MET</b> but improving (1.47). The average VIP score has been improving - a 22% improvement from 91-95 (VIP=1.89) to 01-03 (VIP = 1.47). The VIP score is a rating from 1 to 4 with 1 = excellent.

While most specific goals have been met, there are still concerns related to the original problems in Town Lake.

- Maintenance of no more than one bloom per year may be due to decreases in clarity and PO<sub>4</sub> concentrations from 91-95 levels. Also see the concerns listed under Table 1 relative to algae blooms.
- 20% of the zinc levels and all of the lead concentrations are greater than the TEC.

## Strategies

The majority of the strategies and watershed specific target goals were also achieved. The status of the strategies and watershed specific target goals is presented in Table 4. Loads are estimated by flow weighted storm concentrations from Shoal Creek at 12<sup>th</sup> Street representing the urban watersheds, and Barton Creek at Loop 360.

**Table 4. Status of Strategies in 2004**

<b>Problem Area</b>	<b>Strategies and Watershed Specific Target Goals</b>	<b>Status in 2004</b>
<b>Algae Blooms</b>	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%.</li> <li>➤ Maintain existing load from Barton Creek.</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads.</li> </ul>	<ul style="list-style-type: none"> <li>➤ PO4 is down 55%. Other nutrient load have remained the same.</li> <li>➤ Ammonia is down 86%. Other nutrient loads have remained the same.</li> <li>➤ While some nutrient parameters have increased during some flow/weather conditions, the overall pattern shows a maintenance of existing conditions.</li> </ul>
<b>Toxic Sediments</b>	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%</li> <li>➤ Maintain existing load from Barton Creek</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads</li> <li>➤ Improve the Spills Risk score to Very Good status in the future.</li> </ul>	<ul style="list-style-type: none"> <li>➤ TSS concentrations are down 62%.</li> <li>➤ TSS concentrations are down 57%.</li> <li>➤ Lake Austin TSS concentrations have not increased.</li> <li>➤ The Spills Risk score has not been calculated.</li> </ul>
<b>Sedimentation</b>	<ul style="list-style-type: none"> <li>➤ Reduce loads from urban watersheds by 25%</li> <li>➤ Maintain existing load from Barton Creek</li> <li>➤ Reduce the increase of loads from Lake Austin to no more than 10% above existing loads</li> <li>➤ Minimize loads from future construction</li> </ul>	<ul style="list-style-type: none"> <li>➤ TSS load from the urban watersheds was reduced by 62%</li> <li>➤ TSS load from Barton Creek was reduced by 57%</li> <li>➤ Lake Austin TSS concentrations have not increased.</li> </ul>

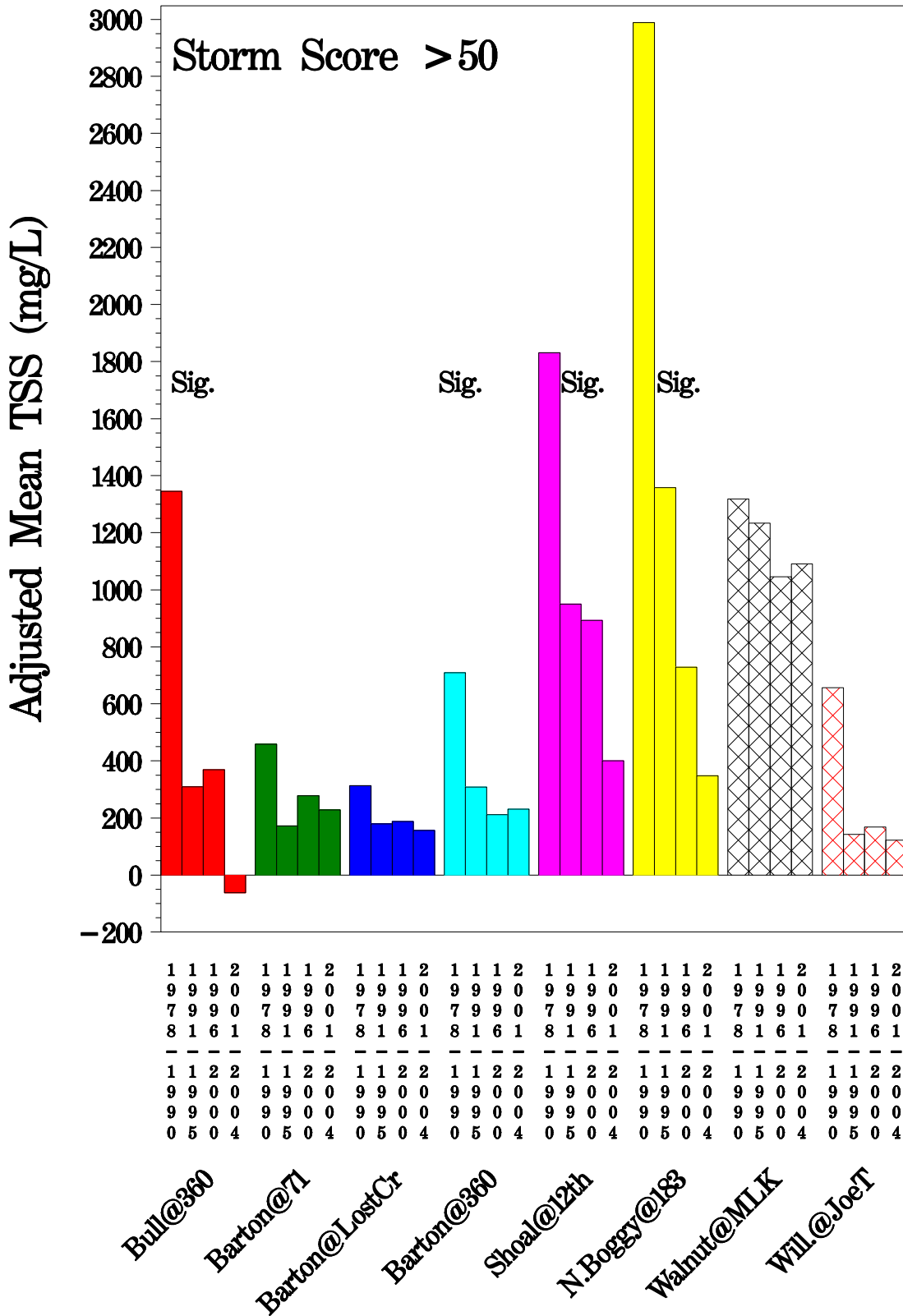
## Conclusions

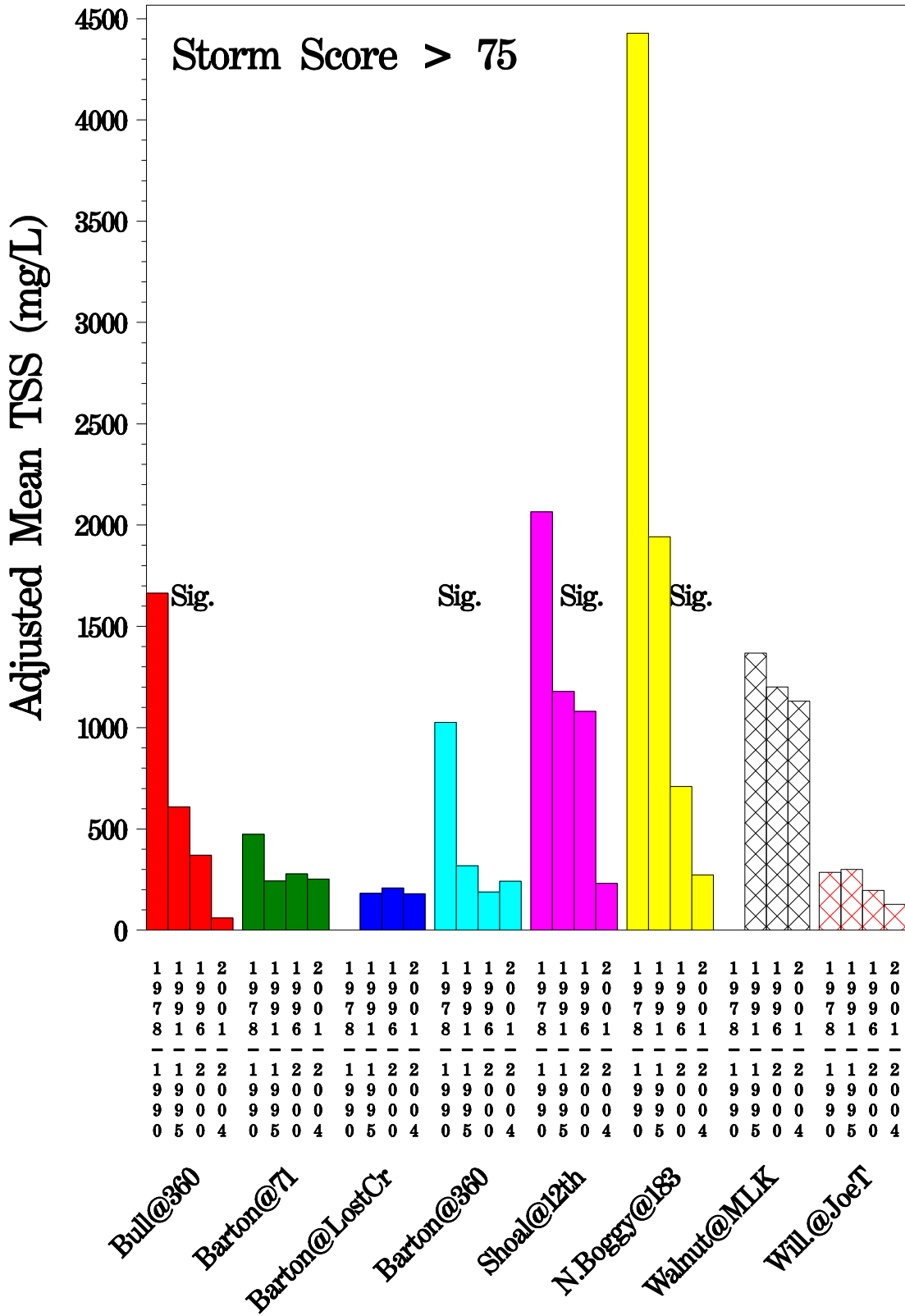
- The goals for Town Lake and the strategies for meeting the goals have been met, except for nutrient load reduction in urban creeks.
- There are still reasons for concern:
  - Mercury in Town Lake fish exceeds recently lowered EPA advisory levels
  - PAHs in sediment were not a problem in Town Lake when the goals were set, but are now over concern levels
  - Some Chlordane, DDE, Zinc and Lead sediment concentrations still exceed concern levels
  - Average chlorophyll *a* concentrations have increased to the border between oligotrophic and mesotrophic conditions.
- The reasons for the decline in sediment loads, and the urban dissolved phosphorus loads are unclear. Additional study is necessary to assess possible causes.

## References

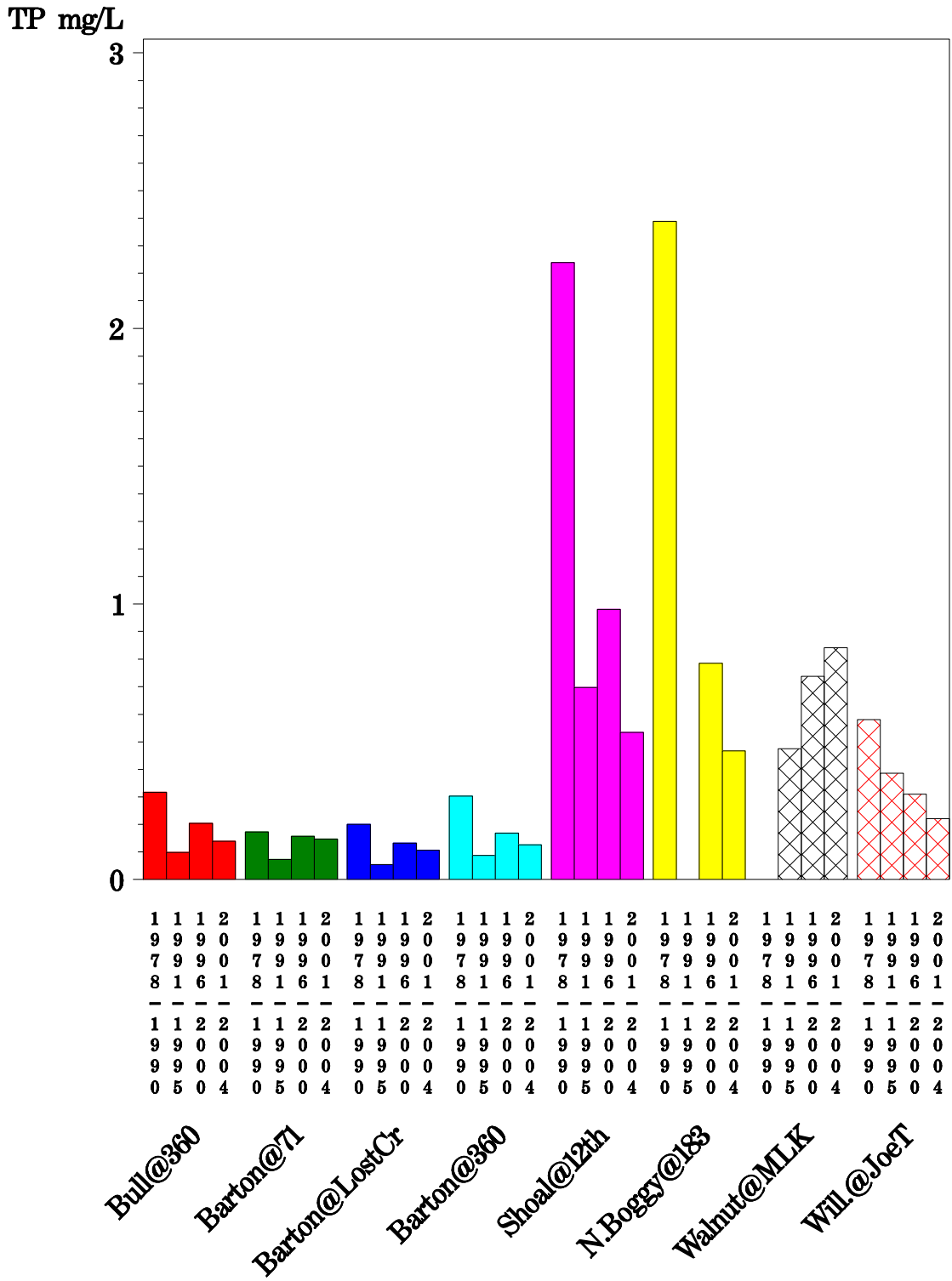
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Some plots relative to storm loading:





Storm Score > 75



1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2								
9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0	9	9	9	0				
7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0	7	7	7	0				
8	8	1	6	1	8	8	1	6	1	8	8	1	6	1	8	8	1	6	1	8	8	1	6	1	8	8	1	6	1	8	8	1	6	1	8	8	1	6	1
1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2				
9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0
9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0	9	9	0	0
0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4	0	5	0	4				

There were more large storms in the early period. This would increase the slope of the line used to estimate the marginal means. However the effect is to lower the marginal mean TSS for the early storms, thus resulting in an underestimate of the change over time.

